No. 10.— *A Revision of the Ants of the Genus Formica (Linnê) Mayr.*[1]

By William Morton Wheeler.

No revision of the American ants of the circumpolar genus Formica has been published for many years, notwithstanding the fact that it comprises some of the most important members of our insect fauna. Mayr,[2] who in 1886 first attempted a revision of this genus, cited only seven species and seven varieties from North America. We are indebted to Emery, however, for the first really serious account of these ants. In 1893 this investigator gave us, in a very succinct and admirable paper,[3] a critical account of all the known American forms, on the basis of collections made by Mr. Theodore Pergande and Rev. P. J. Schmitt. In this paper eight species, twelve subspecies, and fifteen varieties are recognized as being peculiar to our fauna. During the twenty years that have since elapsed a much greater amount of material has found its way into public and private collections, and during the past thirteen years I have described several species and have accumulated both through my own efforts and through the very generous aid of many correspondents so large a collection of Formicae, that it seems advisable again to "take account of stock" of the North American forms. A study of all this material enables me to recognize thirty-one species, nineteen subspecies, and forty-three varieties as belonging to our fauna. Since many of these are very closely related to the Palaearctic or Eurasian forms I have included a brief account of the latter in the present paper. In this part of my work I have made extensive use of Emery's recent revision of the Palaearctic ants.[4]

The species of Formica can be readily distinguished from the species of the other genera of the subfamily Camponotinae by the following characters:—

The workers are small or medium-sized ants, often varying consid-

[1] Contributions from the Entomological Laboratory of the Bussey Institution, Harvard University. No. 59.

[2] Die formiciden der Vereinigten Staaten von Nordamerika. Verh. Zool. bot. ver. Wien, 1886, **36**, p. 419–464.

[3] Beiträge zur kenntniss der nordamerikanischen ameisenfauna. Zool. jahrb. Syst., 1893, **7**, p. 633–682, 1 pl.; 1895, **8**, p. 257–360, pl. 8.

[4] Beiträge zur monographie der formiciden des paläarktischen faunengebietes. (Hym.) Teil. 7. Deutsch. ent. zeitschr., 1909, p. 179–204, 16 figs.

erably in stature but only feebly polymorphic. Their mandibles have a broad, dentate apical border. The maxillary palpi are 6-jointed, very rarely 5-jointed, the fourth joint not longer or but slightly longer than the fifth; the labial palpi are 4-jointed. The clypeus is trapezoidal and usually distinctly carinate; the clypeal and antennal foveae are confluent. The frontal area is usually very distinct; the frontal carinae are subparallel or diverging behind. The eyes are convex, moderately large, and situated behind the median transverse axis of the head. The ocelli are always distinct. The antennae are 12-jointed and inserted near the posterior corners of the clypeus; their funiculi are more or less thickened apically but without a club. The thorax is distinctly and often deeply constricted in the mesoëpinotal region. The epinotum is angular or rounded in profile and always unarmed. The petiole is scale-like, erect and compressed anteroposteriorly.

The female is usually considerably larger than the worker, but in some parasitic species, of the same size or even smaller than the largest worker forms. The anterior wings have a discoidal and a single closed cubital cell.

The male is always larger than the worker and usually slightly smaller than the female. The mandibles are narrow, flat, and pointed, with short, dentate or edentate apical border. The frontal carinae are very short or vestigial; the antennal scapes long, the first funicular joint longer than the second. The petiole is thicker and less compressed anteroposteriorly than in the worker and female. The genitalia are robust and conspicuous, their stipes simple, without an appendage; the subgenital plate is simple or feebly lobed. The cerci are well developed.

Ruzsky [1] was the first to divide the genus Formica into subgenera by basing a subgenus, Proformica, on the Palaearctic *F. nasuta* Nylander. He also included *F. aberrans* in the same group. All the other species he referred to the subgenus Formica *sens. str.* More recently several additional Palaearctic species of Proformica have been brought to light by Emery and Forel. As now defined, the group is based mainly on the greater length of the first funicular joint of the worker and female and of the genital stipes of the male. But the group is, on the whole, rather vague, for the recently discovered Tunisian *Proformica emmae* Forel has close affinities with Cataglyphis (Myrmecocystus *olim*), and our North American *F. neogagates*,

[1] The ant fauna of the Kirghiz Stepps. (In Russian). Horae Soc. ent. Ross., 1903, **36**, p. 294–316).

which has several of the characters of Proformica, is in general habitus more like a true Formica. Emery [1] and I, however, have independently reached the conclusion that this ant is properly a Proformica.

A study of our North American Formicae shows that *F. pallidefulva sens lat.* is even more worthy than Proformica of ranking as a distinct subgenus, for the male differs from that of the other species in much the same manner as does the male of Proformica, while the worker in the structure of the thorax and antennae is even further removed from the species of the subgenus Formica. I have therefore erected a new subgenus, Neoformica, to include *F. pallidefulva* and its various subspecies and varieties and *F. moki* Wheeler. The latter form is provisionally placed in this group because its male and female phases are still unknown.[2]

It is possible, as Emery clearly showed, to separate the various species of the subgenus Formica into groups. These are more sharply defined in the present paper. The *rufa*-like species with diminutive females I regard as constituting a distinct group (*microgyna* group), although I am unable to find any satisfactory worker characters on which to base it. The *exsecta* group is so sharply defined as scarcely to admit of discussion. I have expanded the *sanguinea* group by including in it a number of species with notched clypeus though lacking the parasitic or slave-making habits of the typical *sanguinea*. These species may have to be placed in a group by themselves when our knowledge of their sexual phases is more advanced. The *rufa* group, especially in North America, presents the greatest difficulties in the delimitation of species. This was clearly recognized by Emery, who would be the first to admit that his treatment of our *rufa* forms was inadequate on account of the insufficient amount of material at his disposal. I have endeavored to reduce the confusion by recognizing the Eurasian *truncicola* as a distinct species and by referring to it a number of forms (*integroides*, *integra*, and *obscuriventris*) which have been hitherto regarded as subspecies or varieties of *rufa sens. str.* The habits of all these American forms agree very closely with those of the Eurasian *truncicola* and differ from those of *rufa* and its sub-

[1] Der wanderzug der Steppen-u. Wüstenameisen von Zentral-Asien nach Süd-Europa und Nord-Afrika. Zool. jahrb. Suppl., 1912, **15**, p. 95–104. Emery's statement refers only to *F. lasioides*, which in my opinion is merely a subspecies of *neogagates* (*vide infra*).

[2] That the ethological affinities of Proformica and Neoformica with Formica *sens. str.* are extremely close is shown by the fact that such form as *P. neogagates* and *N. incerta* sometimes function, either alone or in company with *F. fusca*, as slaves, or auxiliaries of *F. sanguinea*.

species *pratensis*. In order to simplify the treatment of the forms in the *fusca* group I have proceeded in a similar manner to raise *cinerea* and *rufibarbis* to specific rank. The constant presence of erect hairs on the gula in the former and the peculiarities of nidification and of temperament in the latter, and the complete absence or extreme rarity of transitions between these forms and *fusca* certainly justify this procedure.

Among the Nearctic and Palaearctic Camponotinae the only genera at all closely related to Formica are Polyergus, Lasius, Myrmecocystus, and Cataglyphis. The parasitic genus Polyergus is now generally believed to have been directly derived from Formica. This may be admitted without accepting Wasmann's more specific assertion that it has arisen from *F. sanguinea*, since there is no morphological basis for this statement but merely the inference that the slave-making habits of Polyergus are in a more advanced or specialized stage of phylogenetic development than those of *sanguinea*. It is, of course, possible that the slave-making habits have been developed independently in the two genera. Lasius has been quite distinct from Formica since Eocene or even Mesozoic times, since we find in the Baltic amber, which is attributed to the Lower Oligocene, a typical Lasius (*L. schiefferdeckeri* Mayr), scarcely distinguishable from small varieties of the existing *L. niger* L., and a species of Formica (*F. flori* Mayr) perhaps identical with the living *F. fusca*. The relations of the genera Myrmecocystus and Cataglyphis have been recently considered by Emery.[1] The Old World species of Cataglyphis were supposed to be congeneric with the American species of Myrmecocystus till a few years ago, when I showed that the New and Old World forms must be at least subgenerically distinct owing to the differences in the males and in the arrangement of the ammochaetae in the workers and females.[2] More recently Emery and Forel have separated them generically, and the former author concludes that the New World Myrmecocystus arose from the genus Lasius, whereas the Old World Cataglyphis was derived from Proformica. If we accept this conclusion Myrmecocystus and Cataglyphis are heterophyletic genera and their similarity is due either to their having arisen from allied genera or to their having converged through adaptation to life in dry, hot deserts.

There has been some discussion between Wasmann and Emery concerning the phylogeny of the species representing various groups

[1] Der Wanderzug etc. *Loc. cit.*, p. 102.

[2] Honey-ants, with a revision of the American Myrmecocysti. Bull. Amer. mus. nat. hist., 1908, **24**, p. 345.

of Formica *sens. str.*, notably concerning *fusca, rufa,* and *sanguinea.* Wasmann,[1] starting from purely ethological considerations, has endeavored to show that the *rufa* forms have arisen from *fusca* and have in turn given rise to *sanguinea.* In support of this view he calls attention to *F. flori* of the Baltic amber and its very close resemblance to the living *fusca.* The absence of *rufa* and *sanguinea* in the amber seems to be taken to indicate that they had not yet been evolved from *fusca.* This argument is very specious, but a moment's consideration shows its feebleness for, as Emery has pointed out, the mandibles of the male *flori* are completely edentate like those of the modern *fusca* and of many members of its group, whereas the males of *sanguinea* and of many forms of the *rufa* group have distinctly dentate mandibles. We cannot, therefore, derive these forms from *fusca,* since it would be contrary to phylogenetic methods to assume the re-development of denticles on the vestigial mandibles of the descendant of a form in which the denticles had already completely disappeared in the early Tertiary. There is, in fact, nothing to indicate that *fusca* is the type of the most primitive and ancestral group of Formicae or that it is older than *sanguinea* or *rufa.* Emery may be quite right in supposing that these species are quite as old as *fusca* and that the conditions in the amber may be due to *sanguinea* and *rufa* having their origin in America, Eastern Asia, or the polar regions and not having entered the Baltic region till after the amber fauna had become extinct.[2]

Our knowledge of the geographical distribution of the North American Formicae has been very imperfect heretofore, owing to the small amount of material which has passed through the hands of myrmecologists. For this reason I have given prominence to the subject in the present paper by citing all or nearly all the localities from which I have seen specimens. These localities are sufficiently numerous, at least in the case of the more common forms, to enable us to form a fairly accurate conception of their geographical range. I could have

[1] Ueber den ursprung des sozialen parasitismus, der sklaverei und der myrmekophilie bei den ameisen. Biol. centralbl., 1909, **29**, p. 587 *et seq.*

[2] Since this paragraph was written I have discovered in addition to *F. flori* four undescribed species of Formica in the Baltic amber. One of these, *F. horrida,* sp. nov. is closely related to *cinerea,* another, *F. phaëthusa,* sp. nov. to *truncicola,* another, *F. clymene,* sp. nov., to *rufa,* and the fourth, *F. strangulata,* sp. nov., in the peculiar structure of its thorax, recalls certain species of Prenolepis (*e. g. P. imparis* Say). I find also that the ant described by Mayr as *Camponotus constrictus* may be more properly regarded as an aberrant Formica. These six species show very clearly that the genus Formica was quite as highly specialized in the early Tertiary of Northern Europe as it is at the present time, and that speculations, like those in which Wasmann has been indulging, are utterly futile and misleading.

wished to see more material from British America, from the states of Kentucky, Tennessee, Alabama, and Mississippi and from the mountains of Northern Mexico. These are regions in which, unfortunately, very few ants have been collected.

Formica, Lasius, Stenamma, and Myrmica are the only circumpolar genera that are confined to the Northern hemisphere. Of these Formica is the most eurythermal, ranging in Europe, Asia, and North America from a latitude of 30° to 60° or 65°, and therefore nearly to the Arctic circle.[1] In altitude the species range from sea-level to above timberline on our loftiest mountains (12,000 to 12,500 ft.). The species of both Lasius and Myrmica are more stenothermal, as they spread neither so far north nor so far south, nor to such altitudes. In passing I may note that I have seen no specimens of Formica from Florida although I have studied many collections of ants from that state. The single species known to me from Mexico (*F. perpilosa*) occurs only on the high plateau. In all probability a few other forms, such as *F. gnava* and *F. pilicornis*, will eventually be found in the same region.

The various species, subspecies, and varieties of Formica differ considerably in habitat. Thus *F. pallidefulva sens. str., moki, pilicornis, perpilosa*, and the various forms of *rufibarbis* are so decidedly xerothermal that they are confined to rather arid portions of the upper and lower austral zones in the southern and southwestern states, whereas the typical *fusca* and its varieties *subaenescens, marcida*, and *gelida, F. sanguinea subnuda* and *F. ulkei* are essentially boreal or subalpine and properly belong to the Canadian and Hudsonian zones. The majority of the species, however, are characteristic insects of Merriam's transition zone.

Practically all of the species find their optimum environment in hilly or mountainous country at moderate elevations, where there are open woods and thickets of deciduous or mixed trees and shrubs, where the rain-fall is abundant and there is nevertheless plenty of heat and sunshine during the summer months, and where, owing to the sloping surface of the soil and abundance of stones, the land is neither flooded nor parched during certain periods of the year. Hence we find the species of Formica most conspicuously abundant and their colonies most numerous and populous in the mountain regions of both

[1] Kolbe (Glazialzeitliche reliktenfauna im hohen norden. Deutschr. ent. zeitschr., 1912, p. 33–63) mentions Formica (presumably *F. fusca*) as occurring even as far north as 67° 34′ at Werchojansk on the Jana River in the province of Irkutsk, Siberia. This is said to be one of the coldest spots on the planet, with a minimum temperature of −60° to −67° C.

continents, notably in the Rockies and Alleghanies, in the Alps, Caucasus, and Ural Mountains. A similar though less pronounced abundance of species and colonies is noticeable in the hilly or rolling portions of the transition zones of both continents, owing to the similar, though somewhat less favorable conditions of temperature, moisture, and vegetation. In more level and arid regions, such as the deserts, the genus Formica is replaced by Myrmecocystus in the New, and Cataglyphis in the Old World.

If we divide the total number of known Formicae (144) into Old and New World forms, we find that Eurasia possesses only fifty-two, whereas North America, though a much smaller land area, possesses ninety-three species, subspecies, and varieties.[1] This would seem to indicate that the latter continent must be the original home of the genus, especially as it possesses representatives of all the Eurasian groups of species besides two peculiar to itself (the *microgyna* group and the subgenus Neoformica). Unless we accept the view that the genus arose in the polar region during Mesozoic times and radiated its species out into Europe, Asia, and North America, we must suppose that Eurasia has received its species by immigration from the Nearctic region. That the latter view is the more probable is shown by a glance at the distribution of the forms in America. At least thirty-nine of our ninety-three forms, or nearly 42%, occur in Colorado and the adjacent portions of New Mexico. Not only are these two states thus abundantly supplied with species, subspecies, and varieties but the colonies of the individual forms are unusually numerous and flourishing on the mountain slopes of this territory. We may therefore regard the southern ranges of the Rocky Mountains in the United States as the center of origin of the genus and of the dispersal of species to other portions of North America.

Formica thus affords striking confirmation of the views of Adams [2] and Scharff [3] that the southwestern states and the adjacent portions of Mexico are the seat of one of the most active North American centers of species formation and dispersal of both plants and animals. It is true that the Formica center does not accurately correspond with the southwestern center as defined by Adams for the biota in general, since the former lies somewhat further north and is much less arid,

[1] One of the species, *F. fusca*, is counted twice, because it occurs in both hemispheres.

[2] The Postglacial dispersal of the North American biota. Biol. bull., 1905, 9, p. 53–71, 1 fig.

[3] Distribution and origin of life in America. Macmillan Co. 1912.

but this is, perhaps, a matter of minor importance. Both Adams and Scharff recognize another center of species formation and dispersal in the southeastern states, but none of our Formicae seems to have arisen in this region, although this does not apply to other ant-genera. *F. pallidefulva* is the only species of the genus that might be supposed to have originated in such a center, but the occurrence of some of the subspecies of *pallidefulva* as far west as Texas, New Mexico, and Colorado and the existence of an allied species, *F. moki*, in Utah and Arizona are by no means inconsistent with a southwestern origin. There seems to have been some obstacle to the spread of many forms westward from Colorado and New Mexico, for no forms of *rufa* or *sanguinea*, or of the *microgyna* and *pallidefulva* series are known to occur in California.

If we assume that the genus Formica had its origin in a southwestern center, we must conclude that the emigration of species from this region to other parts of North America and especially to Asia over a Bering Sea land-bridge and to Europe across Scharff's Greenland-Iceland land-bridge, has extended over a very long period of time. The first emigrants must have reached the Old World before Oligocene and probably as early as late Mesozoic times, because we find *F. flori* as a common ant in the Baltic amber. Precursors of the *rufa*, *sanguinea*, and *exsecta* groups must have reached the Old World at the same time or somewhat later. That these various species have since occupied the territory which they invaded, without being dislodged during the glacial epoch is very probable. Both Kolbe [1] and Scharff have recently given good reasons for maintaining that the biogeographical conclusions so generally accepted as following from the statements of those geologists who have asserted the existence of a very extensive and severe glaciation of the northern portions of all the great land masses in the northern hemisphere during the Pleistocene, must be, to a considerable extent, erroneous. These investigators hold that glaciation could not have been so extensive as to have "sterilized" the greater part of North America and Eurasia, but that temperature and other conditions during the Pleistocene must have been sufficiently favorable to admit of the survival of a rather considerable fauna and flora in the immediate neighborhood of the glaciers. Hence many species were able to maintain the station which they had occupied since early Tertiary or Mesozoic times. As it is probable that these views will before long cause a revolution in

[1] Glazialzeitliche reliktenfauna etc. *Loc. cit.*

our biogeographical and geological conceptions, it is timely to call attention to the fact that the boreal distribution of the species of Formica, especially of the typical *F. fusca*, is in complete accord with the views of Kolbe and Scharff. This is also true of certain other ants, *e. g. Camponotus whymperi, Lasius niger* and several of the species of Myrmica.

In order to facilitate the identification of the various species, subspecies, and varieties of Formica, I append dichotomic tables of the worker phases. I have added tables of the females of the *rufa* and *microgyna* groups, because their females are usually much more easily identified than their workers. It is often difficult or impossible to identify isolated Formica workers or specimens that are not perfectly clean and well preserved. For this reason the collection and description of single worker specimens of these ants, as if they were butterflies or beetles, should be discouraged.

KEY TO THE SUBGENERA AND GROUPS.

1. First funicular joint of worker and female about as long as the second and third joints taken together, the latter shorter or at least not longer than the penultimate joints. Frontal carinae short, subparallel, not diverging behind. Stipes of male genitalia much longer than the volsellae and sagittae. Small, mostly smooth, shining, dark-colored species.

   Subgenus PROFORMICA Ruzsky.

   First funicular joint of worker and female distinctly shorter than the second and third joints taken together, the latter longer than the penultimate joints of the antennae. Stipes of male genitalia but slightly longer than the volsellae and sagittae except in the subgenus Neoformica.

   2. Subgenus FORMICA Linné.

2. Anterior border of clypeus of worker and female, and often also of the male, notched or emarginate in the middle.

   sanguinea group.

   Anterior border of clypeus of worker, female and male entire, rounded or subangularly produced in the middle.....3.

3. Sides of head subparallel, posterior border deeply and broadly excised in the worker and female and often also in the male. Basal border of mandibles with vestiges of denticles.

   exsecta group.

Sides of head of worker usually converging anteriorly, posterior border of head of worker and female straight or convex or at most very feebly excised. Basal border of mandibles without vestiges of teeth.....4

4. Body of worker robust. Head of largest individuals not or scarcely longer than broad. Funicular joints 2–3 longer and more slender than joints 6–8. Petiole usually with rather sharp border. Body opaque, color of species light or dark red with brown or black gaster.....5

Body of worker more slender. Head of largest individuals usually distinctly longer than broad. Funicular joints 2–3 only slightly more slender than joints 6–8. Petiole usually narrow, rather thick and with blunt border. Color and sculpture diverse.....6

5. Female larger than the largest workers, measuring 6–11 mm. . *rufa* group.

Females not larger and sometimes even smaller than the large workers, measuring only 4–6 mm.....*microgyna* group.

6. Thorax of worker rather short. Median joints of funiculi usually less than $1\frac{1}{2}$ times as long as broad; scapes stout, distinctly curved at the base. Petiole flattened behind. Stipes of male genitalia but slightly longer than the volsellae and sagittae. *fusca* group.

Thorax of worker longer. Median joints of funiculi more than $1\frac{1}{2}$ times as long as broad; scapes slender, scarcely curved at the base. Petiole convex behind. Stipes of male genitalia much longer than the volsellae and sagittae. Subgenus Neoformica, subgen. nov.

Subgenus Formica.

Sanguinea group.

Workers.

1. Palaearctic forms.....2
   Nearctic forms.....6
2. Head and thorax rich red or brownish red, head above more or less infuscated.....3
   Head and thorax more yellowish red, head above not infuscated.5

3. Infuscation of head extending down onto the cheeks, leaving only the posterior corners red ..... *sanguinea fusciceps* Emery.
   Infuscation of head less extensive, confined to the front and vertex 4
4. Epinotum obtusely but distinctly angular. . *sanguinea* Latreille.
   Epinotum much rounded. . . . . *sanguinea* var. *mollesonae* Ruzsky.
5. Eyes of the usual size and shape. . *sanguinea* var. *clarior* Ruzsky.
   Eyes smaller and more elongate. . *sanguinea* var. *flavorubra* Forel.
6. Gaster red or ferruginous like the head and thorax. *bradleyi*, sp. nov.
   Gaster brown or black, always darker than the head and thorax . 7
7. Gaster decidedly shining, with very sparse, short pubescence. . 8
   Gaster opaque or subopaque, with longer, dense pubescence . . . 9
8. Erect hairs on head, thorax, and gaster long and dense. Clypeal notch indistinct in small workers. Length of worker 3.5–5 mm., of female 7.5–9 mm. . . . . *perpilosa* Wheeler.
   Erect hairs on head, thorax, and gaster shorter and sparser. Clypeal notch distinct in small workers. Length of worker 3.5–4.5 mm.; of female 6–7 mm. . . . . *manni*, sp. nov.
9. Head, thorax, and petiole brownish testaceous; cheeks straight or slightly concave 10
   Head, thorax, and petiole red or ferruginous; cheeks more or less convex 11
10. Head long and narrow; antennae slender, scapes not thickened towards their tips; body subopaque . . . . . *pergandei* Emery.
    Head shorter; antennae more robust; scapes slightly thickened towards their tips; erect hairs less numerous. . *emeryi*, sp. nov.
11. Hairs on the dorsal parts of the body abundant, conspicuous, glistening white, obtuse or clavate 12
    Hairs less abundant and more slender 13
12. Head and thorax deep red, petiole infuscated; body slender, mesoëpinotal constriction shallow, epinotum long and low. *munda* Wheeler.
    Head, thorax, and petiole yellowish red, body stout, mesoëpinotal constriction deep, epinotum short and high. *sanguinea obtusopilosa* Emery.
13. Front and vertex more or less infuscated. . *sanguinea aserva* Forel.
    Front and vertex not infuscated 14
14. Hairs nearly always absent on the thoracic dorsum and petiolar border, short and few on the head and gaster. *sanguinea subnuda* Emery.

Hairs present on thoracic dorsum, longer and more numerous on head and gaster 15

15. Gaster black 16
Gaster brown 17

16. Body rather opaque; petiole broad, with sharp superior border. *sanguinea rubicunda* Emery.
Body somewhat shining; petiole narrower, with blunter superior border..... *sanguinea rubicunda* var. *lucidula*, var. nov.

17. Sides of head convex; clypeal notch shallow; hairs moderately abundant; tibiae with very fine appressed pubescence..... 18
Sides of head very feebly convex; clypeal notch rather deep; hairs more abundant; anterior surfaces of tibiae with small oblique hairs and without appressed pubescence. *sanguinea puberula* Emery.

18. Head, thorax, and petiole red, gaster dark brown. Clypeal notch feeble but distinct..... *sanguinea subintegra* Emery.
Head, thorax, and petiole yellow, gaster pale brown. Clypeal notch obsolescent. . *sanguinea subintegra* var. *gilvescens*, var. nov.

Rufa group.

Workers.

1. Palaearctic forms..... 2
Nearctic forms..... 12

2. Frontal area opaque; antennal scapes short and robust; whole upper surface of head black..... *uralensis* Ruzsky.
Frontal area shining; antennal scapes longer and more slender; infuscation of head, when present, less extensive..... 3

3. Gaster brown or black, more or less reddish at the base..... 4
Gaster entirely black..... 7

4. Front, vertex, and a small pronotal spot dark brown or blackish; erect hairs on head and thorax usually sparse; eyes hairless. . 5
Front, vertex, and pronotum rarely spotted; body and legs usually more hairy; eyes usually hairy..... 8

5. Head long and narrow, with straight cheeks; thorax slender *rufa* var. *santschii*, nom. nov.
Head short, cheeks more convex; thorax robust..... 6

6. Head, thorax, and petiole red. *rufa* Linné and its var. *rufopratensis* Forel.

Head, thorax, petiole, and legs brown; hairs sparser.
rufa var. *meridionalis* Ruzsky.

7. Head, thorax, and petiole red; black spots on head and thorax large, those on the pro- and mesonotum confluent.
rufa pratensis Retzius.

Head, thorax, petiole, and legs darker and more brownish; black on thorax more extensive. . . *rufa pratensis* var. *nigricans* Emery.

8. Flexor surfaces of tibiae with numerous erect or suberect hairs. . 9
Flexor surfaces of tibiae without erect hairs 11

9. Color of head, thorax, and petiole bright, yellowish red 10
Color and pilosity transitional to *pratensis*.
rufa pratensis var. *truncicolo-pratensis* Forel.

10. Hairs on head and thorax abundant; eyes hairy; gaster dark brown, with red basal spot . . . . . *truncicola* Nylander.
Hairs absent on head and thorax; gaster opaque, black, with red basal spot . . . . . *truncicola dusmeti* Emery

11. Bright red; upper surface of head and clypeus hairy.
truncicola var. *yessensis* Forel.
Deep, dull red; upper surface of head and clypeus without hairs.
truncicola var. *sinensis*, var. nov.

12. Antennal scapes with erect hairs 13
Antennal scapes without erect hairs 14

13. Head and thorax bright yellowish red; legs reddish brown.
orcas Wheeler.
Red portions of body darker; legs dark brown; erect hairs on all parts of the body more abundant, shorter on gaster.
orcas var. *comptula*, var. nov.

14. Cheeks and posterior corners of head very convex and rounded; petiole narrow below when seen from behind, broadened above, with straight transverse superior border 15
Cheeks and posterior corners of head less convex and rounded, petiole not transversely truncated above 17

15. Erect hairs absent on gula and upper surface of head, thorax, and petiole 16
Erect hairs present on gula and upper surface of head, thorax, and petiole . . . . . *dakotensis* Emery var. *montigena* Wheeler.

16. Gaster black or very dark brown; pubescence on head and thorax very short and indistinct . . . . . *dakotensis* Emery.
Gaster paler; pubescence longer and more distinct on head and thorax . . . . . *dakotensis* var. *specularis* Emery.

17. Frontal area opaque . . . . . *foreliana*, sp. nov.
Frontal area smooth and shining 18

18. Petiole narrow and very low, its border very blunt and not produced upward in the middle..... *ferocula*, sp. nov.
Petiole broader and higher, its border sharp, more or less produced upward in the middle.....19
19. Erect hairs absent on gula and upper surface of head and thorax. 20
Erect hairs present on gula and upper surface of head and thorax. 22
20. Small forms (4–6.5 mm.)..... *criniventris* Wheeler.
Larger forms (4–9 mm.).....21
21. Gaster black, somewhat shining, with short, sparse pubescence. *truncicola integra* Nylander.
Gaster dark brown, opaque, densely gray pubescent. *truncicola integroides* Emery var. *haemorrhoidalis* Emery.
22. Eyes hairless.....23
Eyes hairy.....26
23. Erect hairs on gaster very numerous, very short and stubby... 24
Erect hairs on gaster less numerous, longer.....25
24. Gaster blackish brown ..... *comata* Wheeler.
Gaster reddish brown..... *ciliata* Mayr.
25. Gaster dark brown, opaque, densely gray pubescent. *truncicola mucescens*, subsp. nov.
Gaster black, somewhat shining, finely and sparsely pubescent. *truncicola obscuriventris* var. *gymnomma* Wheeler.
26. Head and thorax of small workers decidedly darker than in largest workers.....27
Head and thorax of small workers scarcely or not at all darker than in largest workers.....30
27. Flexor surfaces of tibiae with erect hairs.....28
Flexor surfaces of tibiae without erect hairs.....29
28. Thorax of large workers bright red like the head or at most very feebly infuscated; pubescence on gaster dense. *rufa aggerans* Wheeler.
Thorax of large workers deeply infuscated; pubescence on gaster more dilute..... *rufa aggerans* var. *melanotica* Emery.
29. Head and thorax of large workers entirely or almost entirely without dark spots..... *rufa obscuripes* Forel.
Front, vertex, occiput, and thoracic dorsum of large workers blackish..... *rufa obscuripes* var. *whymperi* Forel.
30. Gaster brown, opaque, densely gray pubescent.....31
Gaster black, feebly shining, sparsely and finely pubescent. *truncicola obscuriventris* Mayr.

31. Erect hairs sparse on upper surface of head, thorax, and petiole. *truncicola integroides* Emery.
Erect hairs on upper surface of head, thorax, and petiole dense and abundant.
truncicola integroides var. *coloradensis*, var. nov.

Females.

1. Palaearctic forms....2
Nearctic forms....5
2. Frontal area opaque; antennal scapes short and stout. *uralensis* Ruzsky.
Frontal area shining; antennal scapes longer and more slender..3
3. Gaster very smooth and shining, scarcely pubescent..*rufa* Linné.
Gaster opaque or subopaque, distinctly pubescent....4
4. Gaster opaque, densely pubescent, brownish black, except the extreme base and tip, which are reddish....*rufa pratensis* Retzius.
Gaster subopaque, brown with red base, or red with fuscous posterior margins to the segments....*truncicola* Nylander.
5. Antennal scapes with numerous erect or suberect hairs....6
Antennal scapes without erect hairs, or with only a few on the posterior surfaces....7
6. Hairs on scapes and legs oblique or suberect....*orcas* Wheeler.
Hairs on scapes and legs more erect; on the body coarser and more abundant....*orcas* var. *comptula*, var. nov.
7. Gaster invested with very long, appressed hairs....8
Gaster not invested with such hairs....10
8. Gaster yellowish red like the head and thorax, its long, appressed hairs hooked or curved at their tips....9
Gaster blackish brown, except the base and anal region; its long, appressed hairs not curved at their tips...*comata* Wheeler.
9. Petiolar border with a fringe of very long hairs....*ciliata* Mayr.
Petiolar border without a fringe of long hairs. *criniventris* Wheeler.
10. Head and thorax very smooth and shining, petiole with transversely truncated superior border....11
Head and thorax opaque or subopaque, petiole not truncated above....13
11. Gaster brown....12
Gaster red with brown posterior borders to the segments. *dakotensis* var. *specularis* Emery.

12. Mesonotum immaculate.....*dakotensis* Emery.
Mesonotum with three dark spots.
dakotensis var. *montigena* Wheeler.
13. Gaster very smooth and shining, with very short, sparse, indistinct pubescence.....14
Gaster opaque or subopaque, with denser, longer pubescence..16
14. Length 7–8 mm. Head and thorax deep red, the former not infuscated. Wings deeply infuscated at the base.
truncicola obscuriventris Mayr.
Length 8–9 mm. Head and thorax dull, yellowish red, both more or less infuscated. Wings only slightly infuscated....15
15. Posterior border of pronotum infuscated.
rufa aggerans, nom. nov.
Pronotum and other portions of thorax more extensively infuscated.....*rufa aggerans* var. *melanotica* Emery.
16. Head and thorax without erect hairs above.....17
Head and thorax with erect hairs above.....19
17. Length 6.5–8 mm. Ground color of head, thorax, and petiole sordid brownish yellow, gaster blackish brown, not paler at the base.....*truncicola mucescens*, subsp. nov.
Length 8–10 mm. Ground color of head, thorax, and petiole bright or deep red, base of gaster red.....18
18. Pubescence on gaster rather sparse and short, so that its surface is subopaque..*truncicola integroides* var. *haemorrhoidalis* Emery.
Pubescence on gaster longer and denser so that its surface is more opaque.....*truncicola integra* Nyl.
19. Hairs on upper surface of head and thorax sparse; wings opaque gray.....*truncicola integroides* Emery.
Hairs on upper surface of head and thorax somewhat more abundant; wings distinctly infuscated at the base.
truncicola integroides var. *coloradensis*, var. nov.

Microgyna group.

Workers.

1. Gaster shining, very sparsely and finely pubescent.....2
Gaster opaque, densely pubescent.....3
2. Head and thorax deep red, gaster black.....*nepticula* Wheeler.
Head and thorax reddish yellow, gaster brown..*morsei* Wheeler.

3. Antennal scapes with erect or suberect hairs....4
Antennal scapes without erect or suberect hairs....5
4. Hairs on antennal scapes coarse and clavate...*impexa* Wheeler.
Hairs on antennal scapes delicate, not clavate.
microgyna Wheeler.
5. Border of petiole blunt; head and thorax rich yellowish red...6
Border of petiole sharp and compressed; head and thorax sordid brownish red....10
6. Gaster black or dark brown, not red at the base....7
Gaster brown, red at the base....9
7. Largest workers with the pro- and mesonotum and also the ocellar region infuscated.
microgyna rasilis var. *spicata*, var. nov.
Largest workers without the head and thorax infuscated or at most with dark ocellar triangle....8
8. Tibiae with abundant, short, subappressed hairs on their extensor surfaces....*microgyna* var. *recidiva*, var. nov.
Tibiae without such hairs....*microgyna rasilis* Wheeler.
9. Erect hairs on head, thorax, and gaster moderately numerous, usually lacking on posterolateral corners of head.
difficilis Emery.
Erect hairs more abundant and longer, especially on the front, gula, and thorax, present on posterolateral corners of head.
difficilis var. *consocians* Wheeler.
10. Posterior portion of head, a spot on the pronotum and one on the mesonotum dark brown or blackish....*adamsi* Wheeler.
Infuscation of head and thorax more restricted, frontal area smoother and more shining....*adamsi* var. *alpina* Wheeler.

Females.

1. Gaster reddish yellow like the head and thorax....2
Gaster brown or black....3
2. Tibiae without long, oblique hairs....*difficilis* Emery.
Tibiae with long, oblique hairs...*difficilis* var. *consocians* Wheeler.
3. Gaster smooth and more or less shining, finely and sparsely pubescent....4
Gaster opaque, with denser, longer pubescence....6
4. Antennal scapes without erect hairs...*microgyna scitula*, subsp. nov.
Antennal scapes with erect hairs....5

5. Antennal scapes with very few erect hairs. . *neptícula* Wheeler.
   Antennal scapes with numerous erect hairs. . . *nevadensis* Wheeler.
6. Antennal scapes with erect hairs. 7
   Antennal scapes without erect hairs. 8
7. Hairs on antennal scapes coarse and clavate. . . . *impexa* Wheeler.
   Hairs on antennal scapes delicate, not clavate.
   microgyna Wheeler.
8. Clavate hairs on head, thorax, and gaster rather short.
   microgyna rasilis Wheeler.
   Clavate hairs on head, thorax, and gaster longer.
   microgyna rasilis var. *spicata*, var. nov.

EXSECTA GROUP.

Workers.

1. Nearctic forms. 2
   Palaearctic forms. 6
2. Antennal scapes thickened towards their tips. 3
   Antennal scapes not thickened towards their tips. 5
3. Posterior half of head black. . . . . *ulkei* Emery.
   Posterior half of head brown or red. 4
4. Gaster brown, subopaque or slightly shining.
   ulkei var. *hebescens*, var. nov.
   Gaster black, more opaque and pubescent.
   exsectoides opaciventris Emery.
5. Petiole thick and narrow, with sharp but not cultrate border, transversely truncated. . . . . *exsectoides* var. *hesperia*, var. nov.
   Petiole thin, broad, with a sharp, cultrate border which is not transversely truncated
   exsectoides Forel and var. *davisi* Wheeler.
6. Head long, its posterior border deeply excised; body opaque or but feebly shining. 7
   Head shorter, its posterior border less deeply excised; body more shining. . . . . *suecica* Adlerz.
7. Clypeus without a transverse impression behind its anterior border; maxillary palpi long. 8
   Clypeus with a transverse impression behind its anterior border; maxillary palpi short. 10

8. Petiole broad, its superior border rounded, entire or only slightly excised in the middle.....*exsecta* var. *etrusca* Emery.
Petiole narrow, its superior border deeply excised in the middle.9
9. Red or sordid yellowish red, posterior portion of head and a large spot on the pronotum brown.....*exsecta* Nylander.
Body paler red, vertex and pronotum each with a small brown spot.....*exsecta* var. *rubens* Forel.
10. Gaster with a red spot at the base.
exsecta pressilabris var. *rufomaculata* Ruzsky.
Gaster without a red spot at the base.....11
11. Gaster, especially at the base, lustrous
exsecta pressilabris Nylander.
Base of gaster opaque, pubescence somewhat longer.
exsecta pressilabris vars. *forcli* Emery
and *exsectopressilabris* Forel.

Fusca group.

Workers.

1. Palaearctic forms.....2
Nearctic forms.....15
2. Gula without erect hairs.....3
Gula with erect hairs.....13
3. Body opaque or subopaque..... 4
Body shining.....12
4. Thorax black, like the head and gaster, in both large and small workers..... 5
Thorax, at least in the large workers, largely red.....7
5. Body dull and opaque, rather coarsely shagreened.
fusca var. *japonica* Motschulsky.
Body subopaque, more finely shagreened.....6
6. Pubescence of gaster short, delicate, not silky.....*fusca* Linné.
Pubescence of gaster, long, silky; head, legs, scapes, and sutures of thorax reddish or yellowish..*fusca* var. *glebaria* Nylander.
7. Largest workers only with red thorax..*fusca* var. *rubescens* Forel.
Thorax rarely infuscated except in small workers.....8
8. Erect hairs lacking or very sparse; pubescence delicate and not very dense; red portions of body pale.....9
Erect hairs more abundant; pubescence denser, red portions of body darker.....10

9. Body opaque, distinctly shagreened. . . *rufibarbis* var. *clara* Forel.
Body subopaque, lustrous, finely shagreened.
rufibarbis var. *caucasica* Ruzsky.

10. Erect hairs yellow: pubescence of gaster without silky luster.
rufibarbis Fabricius.
Erect hairs whitish, pubescence on gaster longer 11

11. Gaster with a bluish tinge . . . . . *rufibarbis* var. *glauca* Ruzsky.
Gaster gray, red of body somewhat paler.
rufibarbis var. *subpilosa* Ruzsky.

12. Length 3–6.5 mm. Epinotum angular in profile, body slender.
fusca picea Nylander and its var. *gagatoides* Ruzsky.
Length 5–7.5 mm. Epinotum rounded in profile, body stout.
gagates Latreille and its var. *fuscogagates* Forel.

13. Body slender, thorax long, with very long, shallow, saddle-shaped mesoëpinotal constriction . . . . . *subrufa* Roger.
Body stouter, thorax of the usual shape 14

14. Body dark brown or blackish.
cinerea Mayr and its vars. *fuscocinerea* Forel and *armeniaca* Ruzsky.
Body light reddish brown . . . . . *cinerea* var. *imitans* Ruzsky.

15. Gula without erect hairs 16
Gula with erect hairs 26

16. Gaster opaque or subopaque, densely pubescent 17
Gaster more shining, very sparsely pubescent 24

17. Thorax black or very dark brown 18
Thorax largely red 21

18. Pubescence on gaster short, not silky . . . . . *fusca* Linné.
Pubescence on gaster longer, denser and silky 19

19. Body black, pubescence not silvery . . *fusca* var. *subsericea* Say.
Body dark brown 20

20. Pubescence on body not silvery, sutures of thorax reddish or yellowish . . . . . *fusca* var. *marcida*, var. nov.
Pubescence on body somewhat longer, denser, and silvery.
fusca var. *argentea* Wheeler.

21. Gaster black or blackish brown; epinotum angular in profile . . . 23
Gaster reddish brown, paler, epinotum rounded in profile 22

22. Gaster more or less infuscated above; length 3–6 mm.
fusca var. *neoclara* Emery.
Gaster not infuscated above, length 3–3.5 mm.
fusca var. *blanda*, var. nov.

23. Length 4–7.5 mm.; gaster opaque, with long, dense pubescence.
rufibarbis var. *occidua* Wheeler.

Length 3.5–6 mm.; gaster somewhat bronzy, slightly shining, with shorter pubescence.....*rufibarbis* var. *gnava* Buckley.

24. Thorax entirely black.....*fusca* var. *subaenescens* Emery.
Thorax more or less red.....25

25. Thorax clear, yellowish red throughout.
fusca var. *necrufibarbis* Emery.
Thorax of large workers infuscated or black anteriorly.
fusca var. *gelida*, var. nov.

26. Body opaque or subopaque, head of largest workers not rectangular.....28
Body shining, head of largest workers rectangular.....27

27. Thorax brownish red or dark chestnut.....*subpolita* Mayr.
Thorax yellow or yellowish brown, head of largest workers with more nearly parallel sides.
subpolita var. *camponoticeps*, var. nov.

28. Antennal scapes with erect hairs, eyes densely hairy.
cinerea pilicornis Emery.
Antennal scapes without erect hairs, eyes not hairy.....29

29. Erect hairs abundant on head and thorax; length 3.5–6 mm...30
Erect hairs very sparse on head and thorax; length 5–6.5 mm.
sibylla, sp. nov.

30. Gaster blackish or dark brown; frontal area opaque.....31
Gaster pale reddish brown, not infuscated above; frontal area shining.....*montana* Emery.

31. Petiole broad, seen from behind cordate, notched in the middle.
cinerea var. *altipetens*, var. nov.
Petiole narrower, with blunt margin, usually entire or obtusely angular in the middle.....32

32. Suberect hairs absent on sides of head and flexor surfaces of legs. 33
Suberect hairs present on sides of head and flexor surfaces of legs.
cinerea var. *lepida*, var. nov.

33. Body dark brownish, top of head and gaster blackish.
cinerea var. *neocinerea* Wheeler.
Body light yellowish red, top of head, pronotum, and gaster brown.....*cinerea* var. *rutilans*, var. nov.

Subgenus Proformica.

Workers.

1. Palaearctic forms.....2
Nearctic forms.....8

2. Gula with long curved hairs (ammochaetae); maxillary palpi long.....*emmae* Forel.
   Gula without ammochaetae, palpi shorter.....3
3. Antennal scapes with suberect hairs.....*aberrans* Mayr.
   Antennal scapes without suberect hairs.....4
4. Erect hairs on body short and clavate.....*kraussi* Forel.
   Erect hairs on body longer, not clavate.....5
5. Head long and narrow, especially in small workers, thorax slender. 6
   Head broader, antennae shorter and thicker, thorax stouter. *mongolica* Emery.
6. Whole body opaque, densely pubescent.....*korbi* Emery.
   At least the gaster very smooth and shining, pubescence very dilute or absent.....7
7. Only the front and clypeus finely longitudinally striated. *nasuta* Nylander.
   Head striated nearly as far back as the occiput. *nasuta* var. *striaticeps* Forel.
8. Antennal scapes with erect hairs.....9
   Antennal scapes without erect hairs.....10
9. Body yellowish brown, gaster and posterior portion of head darker.....*neogagates lasioides* Emery.
   Body black or very dark brown, thorax sometimes piceous or reddish.....*neogagates lasioides* var. *vidua* Wheeler.
10. Erect hairs on dorsal surface of body abundant; body moderately shining.....11
    Erect hairs on body very sparse or absent; body very smooth and shining.....*limata*, sp. nov.
11. Erect hairs on body very delicate.....*neogagates* Emery.
    Erect hairs on body coarser.
    neogagates vars. *morbida*, var. nov. and *vinculans*, var. nov.

Subgenus Neoformica.

Workers.

1. Body opaque.....*moki* Wheeler.
   Body shining.....2
2. Erect hairs present on gula and petiole.....3
   Erect hairs absent on gula and petiole.....5

3. Gaster distinctly infuscated, darker than the head and thorax. .4
   Gaster scarcely darker than the head and thorax, its pubescence longer and denser. . *pallidefulva schaufussi* var. *dolosa* Wheeler.
4. Hairs on gula and petiole numerous and conspicuous.
   pallidefulva schaufussi Mayr.
   Hairs on gula and petiole few, often lacking on one or the other; head, thorax, and gaster darker.
   pallidefulva schaufussi var. *incerta* Emery.
5. Gaster yellow like the head and thorax or but very slightly infuscated. 6
   Gaster dark brown or blackish, head and thorax light or dark brown or reddish. 7
6. Body pale yellow. . . . . *pallidefulva* Latreille.
   Body reddish yellow, pubescence on gaster shorter, whole body smoother. . . . . *pallidefulva* var. *succinea* Wheeler.
7. Head and thorax brown or reddish, gaster shining.
   pallidefulva nitidiventris Emery.
   Head and thorax darker, body often less shining.
   pallidefulva nitidiventris var. *fuscata* Emery.

Subgenus FORMICA (Linné) Ruzsky.

Sanguinea Group.

1. Formica sanguinea sanguinea Latreille.

Formica sanguinea Latreille, Essai hist. fourmis France, 1798, p. 37, ☿ ; Hist. nat. fourmis, 1802, p. 150, pl. 5, fig. 29, ☿ ; Lepeletier, Hist. nat. insect. Hymén., 1836, **1**, p. 203, ☿ ♀ ♂; Förster, Hymen. stud., 1850, **1**, p. 20; Mayr, Verh. Zool. bot. ver. Wien, 1855, **5**, p. 336; Nylander, Ann. sci. nat. Zool., 1856, ser. 4, **5**, p. 62; F. Smith, List Brit. anim. Brit. mus., 1858, pt. 6, p. 115; Mayr, Europ. Formicid., 1861, p. 46–48; Forel, Denks. Schweiz. gesell. naturw., 1874, **26**, *passim;* Lubbock, Journ. Linn. soc. Zool., 1877, **13**, p. 217, pl. 17, fig. 2; Ern. André, Spec. Hymén. Europe, 1882, **2**, pt. 14, p. 180, p. 185, 188, pl. 9, fig. 18; Dalla Torre, Catalog. Hymen., 1893, **7**, p. 211; Bingham, Fauna Brit. Ind., 1903, **2**, p. 336; Ruzsky, Formicar. Imper. Ross., 1905, p. 411, figs. 76–79; Emery, Deutsch. ent. zeitschr., 1909, p. 182.

Formica dominula Nylander, Acta Soc. Fennica, 1846, **2**, p. 905, ☿ ♀ ♂, pl. 18, fig. 15, p. 1047; Ibid., 1849, **3**, p. 26.

Worker. Length 6–9 mm.

Body robust; head, excluding the mandibles, about as broad as long, narrowed in front, with rather straight sides and feebly and broadly excised posterior border. Mandibles broad. Clypeus with a distinct notch in the middle of its anterior border. Pro- and mesonotum in profile slightly depressed; mesoëpinotal impression rather deep and angular; base and declivity of epinotum forming together a rounded angle. Petiole broad, with a sharp border, which is either entire or with a median emargination.

Body subopaque; head slightly lustrous; mandibles finely striato-punctate. Frontal area not shining.

Hairs whitish, sparse, suberect, present on the dorsal surface of the head, pronotum, fore coxae, and gaster, absent on the border of the petiole; short on the upper surface of the gaster, longer and more abundant on the venter. Legs without hairs, except the row of oblique bristles along the flexor surface of the tibiae and metatarsi. Pubescence very fine and sparse on the head and thorax, longer, dense, and grayish on the gaster.

Head, thorax, petiole, legs, and antennae light or dark red; front and vertex more or less infuscated. Gaster black, with the anus and usually a spot at the base of the first segment, red.

Female. Length 9–11 mm.

Color darker and more brownish than that of the worker; head above and behind black; mandibles, clypeus, cheeks, and antennae brown; mesonotum with an anteromedian, and a pair of parapsidal blotches of the same color. Wings brownish, darker towards the base. Pilosity and pubescence as in the worker.

Male. Length 7–10 mm.

Mandibles broad, with 4–5 teeth. Clypeus convex, carinate, with a sinuous emargination in the middle of its anterior border. Head, excluding the mandibles, a little broader than long, with straight posterior border and rounded posterior angles, much narrower in the region of the cheeks, which are shorter than half the eyes and feebly concave. Petiole broad and thick below, with thin, sharp superior border, broadly and rather deeply excised in the middle.

Surface of head and thorax opaque, densely shagreened; gaster somewhat glossy.

Hairs short and sparse; pubescence fine, rather uniform on the head, thorax, and gaster, but not dense enough to conceal the surface.

Black; legs yellow; antennae brown or blackish; scapes sometimes paler; genitalia brownish or reddish yellow. Wings colored like those of the female.

Hosts (Slaves): *F. fusca;* *F. fusca* var. *glebaria*, *F. fusca gagates*, *F. rufibarbis*, and *F. cinerea*.

According to Emery this, the typical form of the species, is distributed throughout the Palaearctic region, but in the southern portions of Europe and Asia occurs only in hilly or mountainous country. In Europe it ranges south as far as Sicily, in Asia as far as the Himalayas (Cashmir) and Lahoul, on the frontier of Thibet.

The workers of *sanguinea* colonies make raids during the summer months on colonies of *F. fusca* and the other species cited above and pillage their pupae. Many of these are devoured, but a number of them are permitted to develop to maturity in the *sanguinea* nests and thus become "slaves," or "auxiliaries." The colonies are therefore said to be of the "mixed" type. When old, however, these colonies often lose the predatory habit and become slaveless. Viehmeyer, Donisthorpe, and Wasmann have shown that the female *sanguinea* establishes her colony by entering a *fusca* nest, appropriating some of the pupae and killing or driving away any of the *fusca* workers that venture to attack her or seek to deprive her of her booty. She guards the kidnapped young and eventually helps them to hatch, thereby surrounding herself with a troop of nurses for her own brood as soon as she begins to lay. This method of colony formation in the typical *sanguinea* is the same as that first described by myself for our American subspecies *rubicunda* and *subintegra* (*vide* p. 408).

The nests of *sanguinea* have the form of low, obscure mounds of earth, or are excavated under stones or logs or around stumps or the roots of plants, and their openings are often banked with a small amount of vegetable detritus. This ant is restless and fond of moving to new quarters from time to time. In some countries it regularly occupies nests in sheltered situations such as woodlands during the winter months but moves to nests in sunny, open places during the summer. When moving to new nests the workers carry the slaves in their mandibles. The worker *sanguinea* is very courageous and fiercely resents interference with its nests, using its mandibles and injecting formic acid into the wounds made with these.

2. F. SANGUINEA SANGUINEA var. MOLLESONAE Ruzsky.

F. sanguinea var. *mollesonae* Ruzsky, Rev. Russe entom., 1903, p. 206, ♀; Formicar. Imper. Ross. 1905, p. 420; Emery, Deutsch. ent. zeitschr., 1909, p. 184.

WORKER. Differs from the worker of the typical form in having the epinotum much more rounded in profile.

Transbaikalia, Siberia.

3. F. SANGUINEA SANGUINEA var. CLARIOR Ruzsky.

F. sanguinea var. *clarior* Ruzsky, Formicar. Imper. Ross., 1905, p. 420, ☿ ; Emery, Deutsch. ent. zeitschr., 1909, p. 184.

WORKER. Differs from the typical form in having the red portions of the body paler and the red basal and apical spots of the gaster more pronounced.

Caucasus.

4. F. SANGUINEA SANGUINEA var. FLAVORUBRA Forel.

F. sanguinea var. *flavorubra* Forel, Ann. Soc. ent. Belg., 1909, **53**, p. 105, ☿ .

WORKER. "Differs from the typical *sanguinea* in its light and vivid red color, which is somewhat yellowish, clearer, and more yellow than in *F. truncicola* Nyl. The base of the first gastric segment is also more or less yellowish red, and the eyes are a little smaller and slightly more elongate.

Ronda, Andalusia" (*Forel*).

HOST (SLAVE). Probably *F. fusca* var. *glebaria.*

5. F. SANGUINEA SANGUINEA var. FUSCICEPS Emery.

F. sanguinea var. *fusciceps* Emery, Zool. jahrb. Syst., 1895, **8**, p. 335, *nota*, ☿ : Deutsch. ent. zeitschr., 1909, p. 184.

WORKER. Red color darker than in the typical form; the blackish brown spot on the vertex extending laterally as far as the eyes and leaving only a small red area on each of the posterior corners of the head.

HOST (SLAVE). Probably *F. fusca* var. *japonica.*

Japan: Yokohama.

6. F. SANGUINEA ASERVA Forel.

.*F sanguinea* st. *aserva* Forel, Ann. Soc. ent. Belg., 1901, **45**, p. 395, ☿ ♀; Wheeler, Bull. Amer. mus. nat. hist., 1906, **22**, p. 85; 1908, **24**, p. 631; Ants, 1910, p. 458, 570.

WORKER. Length 4–7 mm.

Closely related to the typical European form. Clypeal notch rather shallow; clypeal carina more distinct and the surface of the clypeus more convex. Mesoëpinotal constriction a little shallower

than in the typical *sanguinea*. Antennal scapes slender at the base, somewhat enlarged towards their tips. Head relatively large in large workers, almost broader than long, excluding the mandibles, with convex sides, rounded posterior corners and straight or feebly excised posterior border. Petiole broad, with sharp, entire or feebly excised superior border.

Sculpture a little finer than in the typical *sanguinea;* head and gaster more shining; punctures on the occiput rather distinct, scattered.

Hairs yellowish, very sparse, usually absent on the thorax and petiole; short on the gaster. Pubescence shorter and more dilute than in the typical *sanguinea*, so that the surface, especially that of the gaster, appears more shining; very fine and appressed on the legs and scapes.

Color brownish red like that of deeply colored specimens of the typical form; posterodorsal portion of head and often also the middle of the pronotum infuscated or blackened.

Female. Length 7–8 mm.

Sculpture, pilosity, and color as in the worker; metanotum, posterior border of pronotum, and scutellum and three spots on the mesonotum dark brown or black. Head, excluding the mandibles, as broad as long, broader behind than in front, with straight posterior and lateral borders. Scale of petiole broad, much compressed anteroposteriorly, with thin, sharp, entire or feebly emarginate border. Wings colored as in the typical *sanguinea*.

Male. Length 8–8.5 mm.

Mandibles broad, dentate. Clypeus convex, carinate; emargination of its anterior border feeble but distinct. Petiole thick, with rather sharp, transverse border. Hairs and pubescence very short and sparse, so that the thorax and gaster are more shining than in the typical *sanguinea;* head including the mandibles, opaque. Body and antennae black; tips of mandibles brownish; legs brownish yellow. Genitalia rather deeply infuscated. Wings colored like those of the female.

Hosts (Temporary). *F. fusca* and its var. *subsericea*.

Type locality.— Ontario: Toronto, (Forel).

Nova Scotia: Round Hill; Clark's Harbor, Cape Sable Island (A. Halkett).

New Brunswick: Grand Manan (Centr. Exper. Farms Coll.).

Maine: South Harpswell (Wheeler).

New Hampshire: Franconia (Mrs. A. T. Slosson); Summit of Mt. Washington (C. S. Bacon and Mrs. A. T. Slosson).

Massachusetts: Mt. Wachusett (A. C. Burrill).

Connecticut: Colebrook, 1,500 ft. (Wheeler).

Michigan: Isle Royale (O. McCreary).

Wisconsin: White Fish Bay, near Milwaukee (Wheeler); Beaver Lake (C. E. Brown).

Illinois: Rockford (Wheeler).

This subspecies, in color and pilosity at least, is more closely related to the typical European *sanguinea* than is any of the other North American forms. The distribution shows that it is an essentially boreal ant. From a study of it in the type locality, Forel concluded that its colonies contain no slaves. I have shown, however, that the female *aserva* establishes her colony with the aid of workers of *F. fusca* or its var. *subsericea* pillaged as pupae, but that the colony eventually becomes a pure *aserva* colony, because the workers of this subspecies fail to inherit their mother's predatory and dulotic instincts. This explains why Forel failed to find any *fusca* workers in the large colonies which he examined at Toronto. I have seen only two male specimens of *aserva*, both from South Harpswell, Maine, and one of these was immature.

7. F. SANGUINEA RUBICUNDA Emery.

F. sanguinea subsp. *rubicunda* Emery, Zool. jahrb. Syst., 1893, **7**, p. 647, pl. 22, fig. 2, ☿ ♀; Wheeler, Amer. nat., 1901, **35**, p. 711; Bull. Amer. mus. nat. hist., 1906, **22**, p. 74; Ants, 1910, p. 458, 570.

WORKER. Length 5–7 mm.

Head shaped much as in the European *sanguinea*, with rather straight converging sides, feebly excised posterior border and prominent posterior angles; clypeal notch shallower and less pronounced; antennal scapes but slightly enlarged at their tips. Petiole broad, with thin, rather sharp superior border, usually notched in the middle.

Body, especially the gaster, somewhat more shining than in the typical *sanguinea*, owing to the pubescence being a little shorter and sparser.

Hairs, especially on the gaster, longer and more abundant, usually of a rich golden yellow color, but sometimes grayish or whitish. Hairs on the dorsal surface of the head, pro- and mesonotum numerous, and there are usually also a few erect hairs on the gula and petiolar border. Pubescence very distinct, fine, gray, short on the head and thorax, longer on the gaster. Femora with a row of hairs on their flexor surfaces; tibiae with short, appressed pubescence and a row of short bristles on their flexor surfaces.

Color of head, thorax, petiole, and appendages usually lighter and

slightly more yellowish than in the European type; the head not darker than the thorax; mandibles but little darker than the head. Gaster black.

Female. Length 7–9 mm.

Very similar to the worker in sculpture, pilosity, and color. Space between frontal carinae and sometimes also the clypeus infuscated; mesonotum usually immaculate; antennae and tibiae brownish; wings infuscated at the base, in some specimens more strongly than in the European type.

Male. Length 7–9 mm.

Mandibles broad, dentate; clypeus carinate, convex, its anterior border feebly emarginate. Closely resembling the European type in color and pilosity, but the gaster is more shining, owing to its somewhat sparser pubescence. Petiole much thicker and with a blunt border, which is more faintly excised or sometimes even entire and transverse. Antennae black throughout, mandibles reddish only at their tips, which are dentate as in the type. Legs in mature specimens sordid yellow, with the femora more or less infuscated basally. Genitalia yellow, the appendages infuscated at their tips. Wings as in the female.

Hosts (Slaves). *F. fusca* var. *subsericea; F. cinerea* var *neocinerea; F. neogagates; F. pallidefulva schaufussi* and var. *fuscata.*

Type locality.— Pennsylvania (Emery).

New Jersey: Milltown (W. T. Davis); Delaware Water Gap (H. L. Viereck); Woodbury (Phila. Acad. Coll.); Newfoundland (Wheeler).

North Carolina: Black Mts. and Panther Gap, Blue Ridge (W. Beutenmüller).

Massachusetts: Ellisville, Woods Hole, Blue Hills (Wheeler); Springfield, Holyoke (G. B. King).

Connecticut: Colebrook (Wheeler).

Michigan: Marquette (M. Downing).

Illinois: Rockford (Wheeler).

Colorado: Prospect Lake, Colorado Springs (Wheeler).

Montana: Helena (W. M. Mann).

Ontario: Guelph (W. H. Wright).

This subspecies, which is not as common as the subspecies *subintegra* or even *subnuda*, varies considerably in different colonies in the color and character of the pilosity. Thus in my workers from the Black Mountains of North Carolina the hairs on the gaster are gray, very slender, and pointed, whereas in specimens from most other localities they are brilliant golden yellow. Emery cites a single

worker from Labrador as belonging to *rubicunda*, but I believe that it was more probably a specimen of the subspecies *subnuda*. I prefer to cite Pennsylvania as the type locality because it falls within the range of *rubicunda* as indicated by my material and because Emery utilized in his description several worker and female specimens from that state.

I have shown that the female *rubicunda* founds her colony by kidnapping and rearing the pupae of *F. fusca* var. *subsericea*. After the colony is thus established the workers of *rubicunda* make periodical dulotic raids on colonies of *subsericea* and by rearing its pupae maintain a mixed colony. I have always taken *rubicunda* with *F. subsericea, neogagates* or *schaufussi* as slaves except at Colorado Springs, Colo., where the colonies on the shores of Prospect Lake contained instead *F. cinerea* var. *neocinerea*.

8. F. SANGUINEA RUBICUNDA var. SUBLUCIDA, var. nov.

WORKER. Length 5.5–6.5 mm.

Differing from the worker of the typical *rubicunda* in the more shining surface of the body, especially of the mandibles, frontal area, head, and gaster. The hairs and pubescence are well developed but grayish, and the pubescence is much sparser on the gaster. The head is proportionally larger, with more rounded sides and posterior corners, the clypeal notch is shallower and the thorax seems to be more slender; the petiole is narrower and has a blunter superior border, much like the petiole of the subspecies *subintegra*. The body is light red, with deep black gaster and brownish legs.

FEMALE (DEÄLATED). Length 8–9 mm.

Closely resembling the female of *rubidunda* but the thorax is proportionally smaller and narrower. The pubescence on the head, thorax, and gaster is longer than in the worker so that these parts appear to be less shining. One specimen has three fuscous spots on the mesonotum, the other has this region immaculate. The petiole is much like that of the worker and not so broad and sharp as in *rubicunda*.

HOST (SLAVE). *F. fusca* var. *subsericea*.

Described from two females and several workers taken from a single colony on the Stony Brook Reservation, near Boston, Mass. This form may deserve to rank as a distinct subspecies when more material is available. The frontal area is very smooth for a *sanguinea*, almost as smooth and shining as in the *rufa* forms. The thorax is rather slender and recalls the structure of this region in *F. munda* and *F. pergandei*.

9. F. SANGUINEA SUBNUDA Emery.

F. sanguinea rubicunda var. *subnuda* Emery, Zool. jahrb., Syst., 1895, **8**, p. 335, ♀.

F. sanguinea subsp. *subnuda* Wheeler, Ants, 1910, p. 458, 570.

WORKER. Length 5–8 mm.

Head like that of the typical *rubicunda* but the clypeal emargination is much shallower, often reduced to a feeble sinuosity. Epinotum often more rounded and less angular in profile, especially in smaller workers, in larger ones, however, often as angular as in the typical *rubicunda* and *aserva*. Petiole rather broad, with sharp, entire, or very feebly sinuate superior border.

Surface like that of *rubicunda*, the gaster usually slightly more opaque.

Hairs grayish or yellowish, much less abundant than in the typical *rubicunda* and its var. *sublucida*, nearly always completely absent on the thoracic dorsum, gula, and petiolar border. There are only a few hairs on the upper surface of the head and those on the gaster are decidedly short and sparse. Pubescence on gaster dense but finer than on the typical *rubicunda*, concealing the surface; on the thorax and head very sparse or absent and often not perceptible under an ordinary magnification.

Color variable, but usually a light, rich red like that of the typical *rubicunda*, in some cases, however, more brownish; gaster black, as a rule, but occasionally with each segment brownish or reddish towards its base.

FEMALE. Length 8–9 mm.

Closely resembling the worker in sculpture and pilosity, but the red portions of the body somewhat browner. Dark spots on the mesonotum faint or wanting. Wings colored as in the typical *rubicunda*, if anything somewhat more deeply. Clypeal border more deeply notched than in the worker.

MALE. Length 8–9 mm.

Differing from the males of the preceding forms of *sanguinea* in having the anterior border of the clypeus entire and evenly rounded; its surface is convex and carinate. Mandibles dentate. Petiole somewhat more compressed anteroposteriorly and with a sharper border than in *rubicunda*. There are no erect hairs on the head and thorax and the hairs on the gaster are short and sparse. Pubescence short and dilute so that the surface of the head, thorax, and gaster is more shining than in the typical *rubicunda*.

HOSTS (SLAVES). *F. fusca* vars. *subsericea, argentea, subaenescens,* and *gelida;* large colonies often without slaves.

TYPE LOCALITY.— British Columbia: Yale, (Dieck).

British Columbia: Vancouver I.; Field, Carbonate, 2,800 ft., Lake

Minnewonka, Howser, Roger's Pass, Selkirk Mts. (J. C. Bradley); Golden (W. Wenman).

Alberta: Vermillion Pass (E. Whymper); Smith's Landing (H. V. Radford).

Saskatchewan: Methy Lake (R. Kennicott).

Manitoba: Winnipeg (S. H. Scudder).

Quebec: Mingan Island; Niapisca Island; Grand Grève, Gaspé (S. Henshaw); Kingsmere (Wheeler).

Ontario: Rat Portage (J. C. Bradley); Marshall's Bay near Arnprior (C. G. Hewitt).

Nova Scotia: Digby (J. Russell); Port Maitland (W. Reiff); Boisdale, Cape Breton I. (Amer. Mus. Coll.).

Newfoundland: Bay of Islands (Amer. Mus. Nat. Hist. Coll.).

Arizona: San Francisco Mts., 12,000 ft. (W. M. Mann).

New Mexico: Harvey's Ranch, Las Vegas Range, 9,600–10,000 ft. (Miss Ruth Reynolds and E. L. Hewett); Beulah, 8,000 ft. (T. D. A. Cockerell).

Colorado: Breckenridge (P. J. Schmitt); Ward, 9,000 ft., Pike's Peak, 10,000 ft. (T. D. A. Cockerell); Pike's Peak, 11,500 ft., Woodland Park, 8,500 ft., Ute Pass, 8,000 ft., Cheyenne Canyon, Manitou (Wheeler).

Montana: Helena (W. M. Mann).

Idaho: Troy (W. M. Mann).

Michigan: Isle Royale (O. McCreary).

Maine: South Harpswell (Wheeler).

Connecticut: Colebrook, 1,500 ft. (Wheeler).

The foregoing list of localities shows that *subnuda* is a boreal and alpine form like *aserva*, but unlike this subspecies confined very largely to the Rocky Mountains within the confines of the United States. As I have found no transitions between it and the typical *rubicunda*, I believe that it should rank as a subspecies and not as a variety. It is not always easy to separate it from *aserva*. Specimens from Golden and Howser, B. C., are very dark and much like *aserva*, except that the head, even in the smaller workers, is not darker in color than the thorax. The emargination of the clypeus is, however, extremely feeble in these specimens, even feebler than in *aserva* and *rubicunda*.

10. F. SANGUINEA SUBINTEGRA Emery.

F. sanguinea subsp. *rubicunda* var. *subintegra* Emery, Zool. jahrb. Syst., 1893, **7**, p. 648. ☿ ♀; Wheeler, Amer. nat., 1901, **35**, p. 713; Bull. Amer. mus. nat. hist., 1906, **22**, p. 84.

F. sanguinea subsp. *subintegra* Wheeler, Bull. Amer. mus. nat. hist., 1908, **24**, p. 627; Ants, 1910, p. 458, 570.

Worker. Length 4–7 mm.

Head with the posterior corners and sides more rounded than in the preceding forms. Clypeus with broad but shallow emargination. Antennal scapes usually but slightly thickened towards their tips. Pro- and mesonotum not very convex, epinotum somewhat rounded in profile. Petiole thick anteroposteriorly, narrow seen from behind, convex in front, flattened behind, with blunt, usually entire superior border.

Surface of body rather smooth and somewhat lustrous or shining, especially the mandibles and posterior corners of the head; frontal area shining, except in the middle.

Pilosity and pubescence yellow, the former represented by a few hairs on the dorsal surface of the head, sometimes a few on the pronotum and by a number of scattered hairs on the gaster, longest at the tip and on the venter. Rarely there are a few hairs on the petiolar border, and on the gula. Pubescence abundant and dense on the gaster, somewhat finer on the remainder of the body but clearly visible under a lens magnifying 16 diameters. Surfaces of femora and tibiae with very fine, appressed pubescence, which is dense on their anterior and sparse on their posterior faces. Femora without hairs, tibiae with a row of graduated bristles on the flexor surface.

Red color of head, thorax, petiole and appendages usually tinged with yellow. Mandibles darker, with black teeth. Gaster brown.

Female. Length 7–9 mm.

Closely resembling the worker in pilosity and color. Surface of body more opaque. Mandibles, clypeus, front, antennae, tibiae, and tarsi and sometimes also three spots on the mesonotum, brownish. Wings rather heavily infuscated at their bases. Petiole like that of the worker but broader.

Male. Length 7–8 mm.

Mandibles with rather narrow blades, pointed, edentate. Clypeus with rounded, entire anterior border, carinate, often with an indistinct transverse impression just back of its anterior border and another near its posterior end. Petiole thick, transverse, with blunt, feebly and broadly excised dorsal margin.

Pubescence similar to that of the worker, more dilute on the gaster, so that this region appears more shining. Erect hairs very short, confined to top of head, mesonotum and scutellum.

Body black; antennae brown; legs and genitalia yellow; wings rather more heavily infuscated than in the female.

Hosts (Slaves). *F. fusca* and its vars. *subsericea, subaenescens, F. cinerea* var. *neocinerea, F. neogagates* and *vidua; F. pallidefulva schaufussi, nitidiventris, fuscata,* and *incerta.*

Type locality.— District of Columbia (Emery).

Newfoundland: Bay of Islands (L. P. Gratacap).

New Brunswick: St. Stephen (Cent. Exper. Farms Coll.).

Nova Scotia: Digby (J. Russell).

Quebec: Hull, Kingsmere (Wheeler).

Ontario: Guelph (W. H. Wright); Ottawa (Cent. Exper. Farms Coll.).

Maine: S. Harpswell, and Lower Goose Island (Wheeler).

Massachusetts: Sherborn (A. P. Morse); Woods Hole, Ellisville (Wheeler); Springfield (J. A. Allen); Essex County (G. B. King).

Connecticut: New Haven (H. L. Viereck): Colebrook (Wheeler).

New York: Bronxville, Mosholu (Wheeler); Staten Island (W. T. Davis).

New Jersey: Woodbury; New Brunswick (J. B. Smith); Lakehurst, Newfoundland (Wheeler).

Pennsylvania: Beatty (P. J. Schmitt).

Illinois: Rockford, Cherry Valley (Wheeler).

I believe that this form, too, should rank as a subspecies and not as a variety of *rubicunda*. Emery mentions workers from Beatty, Pa., which were transitional in the shape of the head and petiole between *rubicunda* and *subintegra*. I have seen similar specimens from a few of the localities recorded above, but such specimens in pilosity and in the brown color of the gaster are always easily referable to the latter subspecies. The smaller size, the peculiar color of the gaster, the more rounded shape of the head, the narrower, thicker, and blunter petiole of the worker, and the absence of mandibular teeth in the male sufficiently distinguished *subintegra* from *rubicunda*, but its separation from the next subspecies, *puberula* is not so easy. *F. subintegra* is the common form of *sanguinea* in the Eastern States and Canada at low elevations and in warm situations. I have shown that its queens establish their colonies in the same manner as the queens of *rubicunda*.

11. F. sanguinea subintegra var. gilvescens, var. nov.

Worker. Length 4.5–5 mm.

Differing from the typical *subintegra* in the following characters:— The anterior border of the clypens is so feebly notched as to appear merely somewhat truncated in the middle; the erect hairs are very short and sparse on the gaster, almost lacking on the thorax, sparse but somewhat longer on the head, absent on the gula. Color yellow, gaster, head, and antennae tinged with brownish, in more immature specimens the head and antennae are yellow and the gaster is only a little darker than the thorax.

Host (Slave). *F. fusca* var. *subsericea.*

Described from several specimens taken from a single colony at Tuckahoe, N. Y. To the same variety I refer a number of workers which I took from several nests at Calhoun, Waukesha County, Wisconsin, although these specimens are somewhat darker and more reddish. In these respects they are transitional to the typical *subintegra.*

12. F. sanguinea puberula Emery.

F. sanguinea subsp. *puberula* Emery, Zool. jahrb. Syst., 1893, **7**, p. 648, ♀ ; Wheeler, Ants, 1910, p. 458, 570.

Worker. Length 4–6 mm.

Head rather large, in large workers shaped like that of *rubicunda,* with less convex sides, and less rounded posterior angles than in *subintegra.* Clypeal notch broad and rather deep. Antennal scapes often distinctly thickened towards their tips. Thorax and petiole similar to those of *subintegra,* but the latter more compressed anteroposteriorly, less convex anteriorly and usually with a sharper upper border, which is sometimes feebly notched in the middle.

Surface of body as in *subintegra;* mandibles more shining because more densely and superficially striated and less distinctly punctate.

Hairs yellow, more abundant than in *subintegra,* present on the pro- and mesonotum, petiolar border and gula. Those on the gaster are long and slender. Anterior surfaces of tibiae with small, oblique hairs and without appressed pubescence. Pubescence grayish, moderately abundant on the gaster, finer and sparser but still visible on the head and thorax, long on the antennal scapes, especially towards their tips.

Color like that of *subintegra,* the head, thorax, and appendages being yellowish red, the gaster brown.

Female. Length 7–8 mm.

Closely resembling the worker in sculpture, pilosity, and color. Mandibles coarsely striatopunctate. Clypeal notch deep. Antennal scapes considerably enlarged towards their tips. Mesonotum without dark spots. Wings rather deeply infuscated at their bases.

Male. Length 7–8 mm.

Mandibles indistinctly toothed; clypeus convex, carinate, with feebly but distinctly emarginate anterior border. Petiole transverse, low and thick, with blunt, slightly excised superior border.

Pilosity and pubescence much as in the male of *subintegra,* the pubescence perhaps a trifle longer and more conspicuous on the legs.

Black; antennae dark brown; legs yellow, the femora sometimes infuscated. Genitalia brownish. Wings usually very deeply infuscated at their bases.

Hosts (Slaves). *F. fusca* vars. *argentea, subaenescens,* and *neoclara; F. cinerea* var. *neocinerea; F. pallidefulva nitidiventris; F. neogagates lasioides* var. *vidua.*

Type locality.— South Dakota: Hill City, (Emery).

Colorado: Manitou, Colorado Springs, Cheyenne Canyon, Ute Pass, Woodland Park (Wheeler); Breckenridge, West Cliff (P. J. Schmitt).

Utah: Stockton (T. Spalding).

Washington: Pullman (W. M. Mann); Olympia (T. Kincaid).

Montana: Helena (W. M. Mann).

New Mexico: Manzanares (Miss Mary Cooper); Alamogordo (G. v. Krockow); Gallinas Canyon (T. D. A. Cockerell).

Texas: Ft. Davis (Wheeler).

Missouri: Doniphan (P. J. Schmitt).

Illinois: Rockford (Wheeler).

This subspecies replaces *subintegra* at lower altitudes and in warmer situations in the Western States. Occasionally one finds specimens of the latter form which approach *puberula* in the somewhat longer pubescence on the legs and the more abundant hairs on the body. I have taken such specimens at Lakehurst, N. J. The males of *puberula* from Illinois are abnormally small (7 mm.), and in the shape of the clypeus resemble *subintegra.* Apart from the conspicuous differences in pilosity, the workers of the two forms can be separated in nearly all instances by the pubescence, which, on the anterior surfaces of the tibiae, is very fine, dense, and appressed in *subintegra,* but distinctly longer, sparser, coarser, and more oblique in *puberula,* so that in this form it takes on the appearance of minute hairs. I have seen no specimens of *puberula* which show this condition also on the antennal scapes; on these organs the fine, dense pubescence is merely a little longer but scarcely more oblique than in *subintegra.*

13. F. sanguinea obtusopilosa Emery.

F. sanguinea subsp. *obtusopilosa* Emery, Zool. jahrb. Syst., 1893, **7**, p. 648, ♀ ; Wheeler, Ants, 1910, p. 458, 570.

Worker. Mandibles finely striated, feebly punctate. Clypeus rather deeply and broadly notched. Petiole narrow and thick, with blunt superior border, resembling the petiole of *F. pallidefulva.* Gaster opaque, with feeble metallic luster, its pubescence not dense but long and whitish. Erect hairs more abundant than in the other subspecies, whitish yellow, all nearly of the same length, enlarged

FIG. 1.— Distribution of the Nearctic forms of *Formica sanguinea*.

towards their tips which are truncate. The hairs of the thorax have the same form; and there are a few of them also on the border of the petiole (Emery).

Emery described this subspecies from a single worker taken in New Mexico. For some time I attributed several specimens in my collection from the same state to this subspecies, but closer examination shows them to belong to what I described as *F. munda*. I must admit, therefore, that I have never seen the true *obtusopilosa*. My reasons for believing that *F. munda* is a distinct species are given below.

14. F. MUNDA Wheeler.

F. pergandei var. Emery, Zool. jahrb. Syst., 1893, **7**, p. 647, ☿ .
F. munda Wheeler, Bull. Amer. mus. nat. hist., 1905, **21**, p. 267, ☿ ♀ ; Ants, 1910, p. 458.

WORKER. Length 5–7 mm.

Mandibles 8-toothed. Head, excluding mandibles, usually somewhat longer than broad, with straight or slightly convex posterior border and long cheeks, converging anteriorly and slightly convex or flattened. Clypeus sharply carinate, with a rather deep and broad notch in its anterior border. Antennae slender, scapes not enlarged towards their tips. Thorax rather low and narrow, pro- and mesonotum not very convex, mesoëpinotal constriction shallow, epinotum long and low, its basal surface horizontal in profile and somewhat longer than the very sloping declivity into which it passes through a rounded angle. Petiole low and thick, convex in front, flattened behind, with a very obtuse, entire superior border. Seen from behind the border is transverse, broadly rounded, but passing rather abruptly into the straight sides, which converge below. Gaster small; legs slender.

Head and thorax subopaque, very finely shagreened. Mandibles, anterior portion of head, and especially the borders of the frontal area and sides of the clypeus, more shining. Mandibles sharply striatopunctate.

Pubescence grayish, sparse, except on the gaster where it is long and dense and conceals the shining surface, except at the intersegmental incisures. Hairs on the body rather abundant, glistening white, obtuse, suberect, and rather long on the upper surface of the head, thorax, and gaster; on the gaster very regularly distributed. Petiolar border with a row of similar hairs. Legs invested with small, sparse, appressed hairs; femora and tibiae with a row of erect or oblique hairs on their flexor surfaces.

Head, thorax, and antennae red; petiole and gaster black, the former often with a reddish tinge. Mandibular teeth black. Lower pleurae and in many specimens also the vertex of the head, infuscated. Legs red; coxae, femora, and tibiae more or less infuscated, except at the articulations.

Female. Length 7.5–8 mm.

Head small, narrower than the thorax; antennal scapes extending nearly $\frac{1}{3}$ their length beyond the posterior corners of the head. Resembling the worker in pilosity, sculpture, and coloration, except in the following characters: — The hairs are of a yellowish cast, and on the gaster are pointed and of the same thickness as on the head and thorax, although they are long and in certain lights conspicuous, especially towards the tip of the body. Pleurae clouded with fuscous; posterior portion of head, posterior edge of pronotum, and anteromedian and two parapsidal blotches on the mesonotum, fuscous. Metanotum and scutellum, except its anterior border, black. Petiole varying from dark red to blackish, of the same shape as in the worker, except that in profile its superior border is much sharper in some specimens. Wings whitish hyaline, with pale brown veins and stigma.

Type locality.— Colorado: Canyon City (P. J. Schmitt).

Colorado: Breckenridge, West Cliff (P. J. Schmitt); Colorado Springs, Salida, Boulder, Wild Horse (Wheeler); South Boulder Canyon (T. D. A. Cockerell); Troublesome (S. A. Rohwer).

New Mexico: Glorieta, Old Pecos Pueblo (T. D. A. Cockerell).

South Dakota: Medicine Root, Pine Ridge Ind. Reserv. (Thompson). Harding County (S. S. Visher).

Montana: Helena (W. M. Mann).

Alberta: Medicine Hat (J. C. Bradley).

The worker of this species differs from *sanguinea* and resembles *F. pergandei* in the structure of the thorax. The head, especially of large workers, is more like that of small *sanguinea* workers and broader than in *pergandei*. From this latter species and from all the subspecies of *sanguinea*, except, perhaps, *obtusopilosa*, *munda* differs in the peculiar thick, blunt hairs, especially on the gaster. The female is readily distinguished from the female *sanguinea* by the smaller head and longer antennal scapes. Some years ago Professor Emery informed me (*in litteris*) that the specimens which I later described as *F. munda* were identical with the ones he regarded in his "Beiträge" as representing a variety of *pergandei* from Colorado. I infer therefore that *F. munda* cannot be a synonym of his *F. sanguinea obtusopilosa*, as one might be led to believe from a study of his brief description of that subspecies.

F. munda lives in grassy places, especially in irrigated plains and

pastures at altitudes of about 6,000–7,000 ft. The colonies, which are rather small and comprise only a few hundred workers, make small obscure crater nests like those of *F. schaufussi* and its varieties in the Eastern States. I have never found *munda* nesting under stones, and in no colony have I been able to find any slaves. There is, indeed, absolutely nothing to indicate that this ant is ever parasitic or dulotic.

15. F. PERGANDEI Emery.

F. pergandei Emery, Zool. jahrb. Syst., 1893, **7**, p. 646, pl. 22, fig. 1, ♀; Wheeler, Bull. Amer. mus. nat. hist. 1905, **21**, p. 268; Ants, 1910, p. 458, 470.

WORKER. Length 5.5–6.5 mm.

Mandibles 8-toothed. Maxillary palpi short and very slender. Head longer than broad, with long, flat or slightly concave cheeks, converging anteriorly; posterior border straight. Clypeus carinate, not very convex, its anterior margin impressed and rather broadly and deeply notched in the middle. Antennae slender, the scapes not distinctly enlarged towards their tips. Thorax rather long and slender, pro- and mesonotum not very convex, mesoëpinotal constriction well developed, epinotum in profile roundly angular, with subequal base and declivity, the former horizontal, the latter sloping. Petiole narrow, more convex anteriorly than posteriorly, with an obtuse, entire superior border.

Mandibles and clypeus shining, the former finely striated and indistinctly and sparsely punctate, the latter indistinctly, longitudinally rugulose. Head, thorax, and petiole smooth, subopaque, gaster and legs shining. Frontal area shining, except in the center.

Hairs slender and grayish, very sparse on the pronotum and dorsal surface of the head, more abundant on the gaster. There are a few erect hairs on the gula, at least in some specimens. Pubescence very sparse on the head and thorax, longer on the gaster, but not sufficiently dense to conceal its shining surface. Legs and scapes with minute subappressed hairs; tibiae with a row of slanting bristles on their flexor surfaces.

Brownish testaceous; mandibles darker; mandibular teeth and gaster black.

HOST (SLAVE?). *F. pallidefulva.*

TYPE LOCALITY.—District of Columbia: Washington (Th. Pergande). Massachusetts (J. G. Jack).

This species seems to be extremely rare. I have seen two cotypes kindly sent me by Prof. Emery and two specimens from Massachusetts

which agree with these. From the fact that Pergande found the species living with *F. pallidefulva*, Emery has inferred that it is dulotic like *sanguinea*.

F. pergandei is readily distinguished from *sanguinea* by its narrow head and body, its brown color and smoother surface. From *F. munda* it differs in having the erect hairs slender and pointed, in its duller coloration, narrower head and shorter maxillary palpi.

16. F. EMERYI, sp. nov.

F. pergandei Wheeler, Bull. Amer. mus. nat. hist., 1905, **21**, p. 268.

WORKER. Length 4.5–6 mm.

Head a little longer than broad, a little narrower in front than behind, with straight cheeks and posterior border. Mandibles 8-toothed. Maxillary palpi short. Clypeus sharply carinate, its anterior margin neither produced nor impressed but feebly and narrowly notched in the middle. Antennae rather robust; scapes slightly enlarged towards their tips; funicular joints subequal; joints 2–5 a little more slender than the succeeding joints. Thorax rather long, pro- and mesonotum depressed, mesoëpinotal constriction narrow, the posterior surface of the mesonotum falling suddenly to the level of the metanotum; epinotum angular, with subequal base and declivity, the former with a very faint transverse impression in the middle. Petiole narrow; cuneate in profile, with straight posterior and very feebly convex anterior surface, its border entire, rounded and rather sharp. Gaster elliptical, more elongate than in any of the preceding species. Legs stout and rather long.

Mandibles shining, very finely and rather superficially striated, with very fine, scattered punctures. Remainder of body opaque, its surface very finely and uniformly shagreened; gaster with a slightly metallic luster.

Pilosity and pubescence gray, the former represented by only a few erect hairs on the front and clypeus and two transverse rows of sparse hairs on each gastric segment, which are somewhat longer towards the tip and on the venter. Tibiae each with a row of bristles on their flexor surfaces. Pubescence extremely short and inconspicuous on the head, thorax, petiole, and legs, a little longer and much denser on the gaster, so that this region has a grayish tint.

Brown; gaster black; mandibles red; dorsal portion of head infuscated or blackened.

FEMALE. Length 7–7.5 mm.

Closely resembling the worker in sculpture, pilosity, and color. Mandibles much more coarsely striatopunctate. Clypeus with

broader but very shallow emargination. Head large, broader than the thorax, scarcely longer than broad. Antennal scapes reaching only a distance equal to their own diameter beyond the posterior corners of the head. Infuscation of top of head deeper and more extensive than in the worker, covering also the cheeks and clypeus. Mandibles brown. Mesonotum immaculate. Metanotum and posterior border of pronotum infuscated. Petiole like that of the worker in shape. Wings whitish hyaline, without any trace of infuscation, veins and stigma brown.

Host (Slave). *F. neogagates.*

Described from nine workers and four females taken Aug. 8, 1903, from a small colony in the open fields at Broadmoor, near Colorado Springs, Colo. The nest contained several small workers of *F. neogagates,* which were in all probability the slaves of the new species, since winged females of the latter were found in the nest. At first sight *F. emeryi* appears to be merely a variety or subspecies of *pergandei,* but closer examination shows many dissimilarities, especially the smaller size, the greater breadth of the head, the much feebler pilosity, the deeper color, the more opaque surface, and the shape of the thorax in profile. The slight transverse depression in the base of the mesonotum is constant in all my specimens. The female may be readily distinguished from the females of *sanguinea* and *munda* by its color, from *sanguinea* also by the pale, colorless wings, and from *munda* by its much larger head and shorter antennal scapes.

17. F. manni, sp. nov.

Worker. Length 3.5–4.5 mm.

Body slender. Head, excluding the mandibles, longer than broad, a little narrower in front than behind, with straight sides and feebly convex posterior border. Clypeus carinate, its anterior border feebly and rather broadly notched in the middle. Frontal carinae subparallel behind. Antennae slender, scapes not incrassated toward their tips. Thorax long, pro- and mesonotum moderately convex; mesoëpinotal constriction shallow; epinotum angular in profile, with subequal base and declivity. Petiole rather narrow; in profile cuneate, rather thick at the base, gradually narrowed towards the summit, with nearly flat anterior and posterior surfaces, the border rather sharp; seen from behind entire or very feebly excised in the middle. Legs rather long.

Body very finely shagreened, shining, especially the gaster; the clypeus and mandibles somewhat more opaque, finely striated, the former also sparsely punctate.

Hairs whitish, long, rather slender, erect, sparse; conspicuous on the upper surface of the head, clypeus, gula, thoracic dorsum, petiolar border, gaster, and fore coxae. Pubescence very short and sparse, most clearly visible on the gaster and legs but far from concealing the ground surface; scarcely perceptible on the cheeks and pleurae.

Rich red, legs a little paler and more yellowish; small workers darker and more brownish; tips of antennal funiculi and sometimes also the posterodorsal portion of the head in the large workers slightly infuscated; gaster always deep black throughout.

Female (deälated). Length 6–7 mm.

Closely resembling the worker in sculpture, pilosity, and color. The notch in the clypeus is very broad and shallow and the carina very blunt or lacking. The petiole is broad, with a flat, very sharp border. The mesonotum bears three faint brownish blotches, the wing-insertions and sutures of the thorax are blackish and the base of the first gastric segment is red, the posterior borders of the segments yellowish.

Type locality.— Washington: Kiona, (W. M. Mann).

Washington: Wapata, Wenatchee, Ellensburg (W. M. Mann).

California: Owen's Lake (H. F. Wickham).

The series of specimens includes many workers and three females, two from Kiona and one from Owen's Lake. At first sight this species, on account of its smooth and shining body and the character of the pubescence, appears to belong in the *fusca* group, but the structure of the clypeus seems to associate it more naturally with *sanguinea*. In the shape of the body it shows an even closer relationship to *F. pergandei*, *munda*, and *emeryi*. The small size of the female seems to indicate that it is a parasitic species. Mr. Mann informs me that the colonies are small and nest under stones in dry, hot, and often sandy, desert country.

18. F. perpilosa Wheeler.

F. fusca subpolita var. *perpilosa* Wheeler, Mem. revist. Soc. cient. Ant. Alzate, 1902, **17**, p. 141; Herrera, Boll. Comision parasit. agric., 1902, **1**, p. 404.

Worker. Length 3–5.5 mm.

Head in large workers, excluding the mandibles, about as broad as long, a little narrower in front than behind, with straight lateral and posterior borders. Clypeus carinate, its anterior border rounded, entire, or in some specimens slightly truncated or even feebly emarginate in the middle. Antennae rather stout; scapes somewhat thickened towards their tips; basal joints of funiculus narrower but not longer than the penultimate joints. Frontal carinae diverging be-

hind. Eyes rather small. Maxillary palpi moderately long. Pro- and mesonotum, especially the latter, convex; mesoëpinotal constriction short and rather deep; epinotum in profile with subequal base and declivity, both straight and forming a large, obtuse angle with each other. Petiole narrow, cuneate in profile, thick at the base, its anterior surface rather strongly convex, its posterior surface flat, its border obtuse, seen from behind rounded and entire. Legs rather stout.

Body and legs shining; very delicately shagreened, more coarsely on the metapleurae. Mandibles and clypeus subopaque, very finely and densely longitudinally striated, the former also with small, sparse, shallow punctures. Frontal area smooth and shining.

Head, throax, border of petiole, gaster, and fore coxae beset with long, erect, subobtuse, rather slender, silvery white hairs; those on the gula being as long as those on the upper surface of the head. Legs with only a row of hairs on the flexor surfaces of the femora and the usual row of bristles on the corresponding surfaces of the tibiae. Pubescence white, long, and sparse on the gaster, shorter and even sparser on the head, thorax, and legs, very fine and dense on the scapes.

Yellowish red; gaster black; in small workers the posterodorsal portion of the head, and the upper surface of the thorax and petiolar border often dark red or brownish.

Female. Length 7.5–9 mm.

Closely resembling the worker in color, sculpture, and pilosity, but the posterodorsal portion of the head, three large blotches on the mesonotum, the metanotum, and often also the posterior portion of the scutellum, and portions of the meso- and metapleurae fuscous. Gaster sometimes dark reddish brown, with a pale red spot at the base of the first segment. Wings colorless, with brown veins and black stigma. The middle of the clypeal border is flattened, and has a broad but shallow, sinuous excision. The petiole is broad, with a compressed, sharp border which is often produced upward in the middle as a blunt angle.

Male. Length: 7–8 mm.

Mandibles rather short and broad, pointed, edentate. Head broad behind, with straight border, much narrowed in front, with straight cheeks. Eyes large. Clypeus convex, with entire, broadly rounded anterior border. Thorax and gaster rather slender. Petiole low and transverse, somewhat compressed anteroposteriorly, especially above, so that the border is less blunt than in the males of many other species of Formica; seen from behind the border is feebly and broadly excised. Stipes of genitalia with their tips projecting some distance beyond the volsellae and sagittae.

Head and thorax, including the frontal area, opaque. Mandibles, pleurae, and gaster somewhat shining.

Hairs and pubescence grayish, both very abundant, covering the head, thorax, and gaster; the hairs erect and rather short, the pubescence very long; eyes, scapes, and legs hairless.

Black; genitalia heavily infuscated; mandibles brown with yellowish tips; legs yellow, terminal tarsal joint of each foot black; wings uniformly gray, or smoky, with brown veins and black stigma.

Type locality.— Colorado: Canyon City (P. J. Schmitt).

Colorado: Cotopaxi (P. J. Schmitt).

New Mexico: Paraje, Las Valles (T. D. A. Cockerell); Alamogordo (G. v. Krockow).

Arizona: Tucson, Benson (Wheeler); Tempe (T. D. A. Cockerell).

Nevada: Las Vegas (J. C. Bradley).

Texas: San Esteban near Marfa, Langtry, Ft. Davis (Wheeler); Eagle Pass (J. D. Mitchell).

Mexico: Coahuila (A. F. Rangel).

This ant is certainly not a form of *subpolita*, nor does it belong with *fusca*, as I formerly supposed. It is closely related to the preceding species (*F. manni*), but differs in the greater size of the worker and especially of the female, the more robust body and antennae, more convex mesonotum, more abundant and longer pilosity and pubescence. *F. manni* might, perhaps, be regarded as a subspecies of *perpilosa*. The notch in the clypeus of the worker of the latter species is shallower and less constant, especially in small individuals than in *manni*.

Since the original account of this species was published ten years ago, I have had several opportunities of studying it in Arizona and Western Texas. It is preëminently a species peculiar to irrigated lands and river bottoms in the deserts of the southwest. There it nests in rather populous colonies about the roots of bushes or trees, often forming obscure craters or low mound nests, not unlike the nests of *F. subsericea* in the Eastern States. I have never found it nesting under stones. It is a very active and aggressive ant, and, as Herrera has shown, is of some little economic value as a boll-weevil exterminator. There is not the slightest indication that it is either a temporary social parasite or a slave-holder.

19. F. bradleyi, sp. nov.

Worker. Length 3.5–5 mm.

Head, excluding the mandibles, a little longer than broad, a little narrower in front than behind, with straight sides and straight or feebly convex posterior border. Eyes rather large. Clypeus convex, carinate, its anterior border not produced, broadly rounded, with a very shallow, broad excision in the middle. Frontal carinae subparal-

lel behind. Antennae rather stout, the scapes slightly thickened towards their tips; second to fourth funicular joints somewhat more slender but scarcely longer than the antepenultimate joints. Maxillary palpi moderately long. Pro- and mesonotum, especially the latter, rather convex; mesoëpinotal constriction rather deep; epinotum in profile with subequal base and declivity, both straight and forming a large obtuse angle with each other. Petiole rather narrow, thick at the base with convex anterior and flat posterior surface and very blunt border, which is rounded and entire when seen from behind. Gaster rather large. Legs moderately stout.

Surface of body distinctly shagreened, shining; clypeus and mandibles densely longitudinally striate, the latter subopaque and also sparsely punctate. Frontal area very smooth and shining.

Hairs short, stout, obtuse, pale yellow, abundant, and erect, covering the dorsal and gular surfaces of the head, the thorax, fore coxae, petiole, and gaster; absent on the cheeks and pleurae. Pubescence rather sparse on the gaster, but slightly dimming the shining surface, shorter and less conspicuous on the head and thorax. Femora and tibiae with a row of hairs on the flexor surfaces; tibiae also with a few short subappressed hairs near the base on the extensor surface.

Light ferruginous red; mandibles a little darker; gaster if anything a little paler and more yellowish than the thorax.

Male. Length 7 mm.

Mandibles broad, edentate. Head, excluding the mandibles, as broad as long, with convex, broadly rounded posterior border and much rounded posterior corners, short cheeks and very large, convex eyes. Clypeus sharply carinate, with entire, broadly rounded anterior border. Thorax and gaster slender. Petiole low and transverse, very thick and very bluntly rounded above; seen from behind its summit is slightly impressed in the middle. Genitalia with the tips of the stipes projecting beyond the volsellae and sagittae.

Surface of body, including the head and thorax as well as the gaster, shining; mandibles and clypeus more opaque; frontal area smooth and shining.

Hairs and pubescence grayish, more abundant than in the worker, the hairs of the same length, but the pubescence longer. Eyes and scapes hairless; legs with only a row of erect hairs on the flexor surfaces of the tibiae and femora. Pubescence on the legs much shorter than on the body.

Black; genitalia fuscous; tips of mandibles and legs beyond the tips of the coxae, yellow; last tarsal joint on each foot and basal portion of femora blackish. Wings grayish hyaline, the veins and stigma both of the same brown tint.

Type locality.— Colorado: Georgetown, (P. J. Schmitt). Alberta: Medicine Hat (J. C. Bradley).

Described from three workers and two males. A large number of the workers from Alberta are somewhat less shining but agree in other respects with the types.

The worker of this species is easily distinguished from all the other forms in the *sanguinea* group by its uniform red color and dense pilosity, which is much like that of *cinerea*. Indeed, were it not for the emarginaton of the clypeal border, it might be placed in the *fusca* group. The male is also very peculiar in its shining head and thorax, the unusual shape of the head, large size of the eyes and dense pilosity.

Rufa Group.

20. Formica rufa rufa Linné.

F. rufa Linné, Syst. nat., ed. 10, 1758, **1**, p. 580; de Geer, Mem. hist. ins., 1771, **2**, p. 1053, pl. 41, 42, fig. 1–11; Fabricius, Syst. ent., 1775, p. 391; Spec. ins., 1781, **1**, p. 489; Mant. ins., 1787, **1**, p. 308; Latreille, Essai hist. fourmis France, 1798, p. 39, ☿ ♀ ♂; Hist. nat. fourmis, 1802, p. 143, pl. 5, fig. 28, a, b, g, h.; Fabricius, Syst. Piez., 1804, p. 398, ☿ ♀ ♂; Latreille, Hist. nat. ins., 1805, **13**, p. 255; Gen. Crust. ins., 1809, **4**, p. 126; F. Smith, Trans. Ent. soc. Lond., 1842, **3**, p. 151–154; Nylander, Act. Soc. sci. Fennica, 1846, **2**, p. 902, pl. 18, fig. 16, ☿ ♀ ♂; Förster, Hymen. stud., 1850, **1**, p. 13, ☿ ♀ ♂; F. Smith, Trans. Ent. soc. Lond., 1855, ser. 2, **3**, p. 100, pl. 9, fig. 13, ☿ ♀ ♂; Nylander, Ann. sci. nat. Zool., 1856, ser. 4, **5**, p. 60, pl. 3, fig. 3; Mayr, Progr. realsch. Pest., 1856, p. 9, ☿ ; F. Smith, List Brit. anim. Brit. mus., 1858, pt. 6, p. 3; Mayr, Europ. Formicid. 1861, p. 46, 48, ☿ ♀ ♂; Forel, Denks. Schweiz. gesell. naturw., 1874, **26**, p. 52, 55, 57, 364, ☿ ♀ ♂; Bull. Soc. Vaud. sci. nat., 1875, ser. 2, **14**, p. 57, 59; Ern. André, Spec. Hymén. Europe, 1882, **2**, pt. 14, p. 184, 187, 189, pl. 1, 5, 6, 9, ☿ ♀ ♂; Lubbock, Ants, bees, wasps, ed. 5, 1882, p. 441, pl. 2, fig. 5, ☿ ; Dalla Torre, Catalog. Hymen., 1893, **7**, p. 206–209; Ruzsky, Formicar. Imper. Ross., 1905, p. 320, fig. 59–62; Emery, Deutschr. ent. zeitschr., 1909, p. 184.

F. dorsata, v. d. Hooven, Bijdr. natuurk. vet., 1826, **1**, p. 441.

F. obsoleta Zetterstedt, Insect. Lappon., 1838, **1**, p. 449, ☿ ♀.

F. lugubris Zetterstedt, Insect. Lappon., 1838, **1**, p. 449, ♂.

F. polyctena Förster, Hymen. stud., 1850, **1**, p. 15, ☿ ♀ ♂; Schenck, Jahrb. Ver. nat. Nassau, 1852, **8**, p. 25, 137, ☿ ♀ ♂; Stettin. ent. zeit., 1853, **14**, p. 160.

F. truncicola Förster, Hymen. stud., 1850, **1**, p. 21 ☿ , (excl. ♀ ♂).

F. piniphila Schenck, Jahrb. Ver. nat. Nassau, 1852, **8**, p. 28, 138, ☿ ♀ ♂.

F. apicalis F. Smith, List Brit. anim. Brit. mus., 1858, pt. 6, p. 49, ♀.

Worker. Length 4–9 mm.

Resembling *F. sanguinea*. Body rather robust. Head subrectangular, about as long as broad, a little narrower in front than behind, with straight posterior and very feebly convex lateral borders. Mandibles 8-toothed. Clypeus strongly carinate, with entire anterior border. Antennae rather stout, penultimate much thicker and shorter than the basal funicular joints. Pro- and mesothorax very convex, hemispherical. Mesoëpinotal constriction pronounced; epinotum shaped much as in *sanguinea*, but more rounded and less angular. Petiole broad, compressed anteroposteriorly, with a sharp border, which is entire or feebly emarginate in the middle. Gaster large, broadly elliptical, legs long and robust.

Body opaque; mandibles shining, finely striatopunctate; frontal area glabrous and shining. Gaster glossy or feebly shining.

Pubescence fine and abundant; suberect hairs short, usually very sparse on the head and thorax, more abundant on the gaster. Gula almost always with a few erect hairs; eyes hairy. Tibiae with only a few minute slanting hairs in addition to the row of bristles on the flexor surfaces.

Dark or pale red; front, vertex and antennae dark brown to blackish brown; clypeus sometimes with a median longitudinal brown streak; pronotum usually with a small brown or black spot not reaching the posterior border of the segment; gaster blackish brown, its base somewhat reddish.

Female. Length 9–11 mm.

Similar to the worker. Head and thorax opaque, but gaster very smooth and shining. Erect hairs short and sparse, absent on the gaster. Pubescence fine, most distinct on the legs and scapes. Red; front, vertex, mesonotum, the anal region, spots on the pleurae, tibiae, tarsi, tips of femora, middle of clypeus, and gaster, with the exception of its base, dark brown or black. Mandibles dark red, subopaque, coarsely striatopunctate. Wings slightly infuscated, with light brown veins and stigma.

Male. Length 9–11 mm.

Body stout. Head rather small, mandibles edentate or very rarely dentate; masticatory border sharp, with apical point. Clypeus carinate, convex, with entire, angular anterior border. Petiole thick, its anterior and posterior surfaces flattened and its superior border very blunt, rounded and feebly excised in the middle.

Body, including the frontal area, opaque, upper surface of gaster shining.

Erect hairs black and dense on the head and thorax, sparse on the eyes and petiole, almost absent on the gaster.

Black; genitalia, and legs, except the bases of the femora, yellowish or brownish red. Wings like those of the female.

Host (Temporary). *F. fusca.*

North and Middle Europe, south as far as the Pyrenees and southern slopes of the Alps; Caucasus, Siberia; occurring only in the mountains in Southern Europe.

The typical *F. rufa* constructs large mound-nests of vegetable débris, usually pine-needles, in open forests, preferably of coniferous trees. A single colony may have several of these nests, which are connected with one another by run-ways. New colonies (not new nests!) are formed, as Wasmann and I have shown, by temporary social parasitism, the recently fecundated female finding a home in a *F. fusca* colony and permitting these ants to bring up her young. The *fusca* queen is either destroyed by the intrusive *rufa* queen or by her own offspring, so that when the *fusca* workers eventually die off, a pure colony of *rufa* remains. New nests are formed by adoption of *rufa* queens which leave the parental formicary with detachments of workers.

The forms *F. polyctena* Förster and *F. piniphila* Schenck are based on specimens which differ somewhat from the typical form in pilosity; *polyctena* having the head and thorax almost hairless, whereas *piniphila* is more pilose.

21. F. rufa rufa var. meridionalis Nassonov.

F. rufa var. *meridionalis* Nassonov, Arb. Lab. zool. Univ. Moskau, 1889, **4**, p. 17, ☿ ; Ruzsky, Formicar. Imper. Ross., 1905, p. 330; Emery, Deutsch. ent. zeitschr., 1909, p. 186.

Worker. Differing from the typical form in color, the red parts being brownish yellow, the legs brown. Hairs very sparse.

Siberia.

It is not impossible, as Emery seems to imply, that this variety may be based on immature specimens of the typical *pratensis.*

22. F. rufa rufa var. rufopratensis Forel.

F. rufa var. *rufopratensis* Forel, Denks. Schweiz. gesell. naturw., 1874, **26**, p. 53, ☿ ♀ ♂; Emery, Deutsch. ent. zeitschr., 1909, p. 186.

Worker and Male transitional in color and pilosity, and Female in the smoothness of the gaster, between the typical *rufa* and the subspecies *pratensis.* These various characters are combined in the most manifold manner and degrees in different specimens.

North and Middle Europe.

According to Forel, this variety is usually smaller than the typical *rufa* and *pratensis*, more like the former in pilosity and more like the latter in color, but the reverse conditions are also found. The formicaries, too, are intermediate in all respects.

23. Formica rufa rufa var. santschii, nom. nov.

F. rufa var. *alpina* Santschi, Bull. Soc. ent. France, 1911, p. 349, 1 fig., ☿ ; Forel, Rev. Suisse zool., 1911, **19**, p. 457; Emery, Deutschr. ent. zeitschr., 1912, p. 672.

Worker. Differing from the typical *rufa* in having the head proportionally longer and narrower (one fourth longer than broad), the scapes longer and extending further beyond the posterior corners of the head, the thorax narrower, the pro- and mesonotum more convex and the gaster a little larger. In size, color, and pilosity like the typical form.

Mountains north of Sondrio, Northern Italy (G. Valerio). Also in Great Britain, according to Donisthorpe, and Norway, according to Forel.

Santschi believes that this variety of *rufa* may prove to be merely an abnormality produced by entoparasitism of Mermis or Pelodera or by ectoparasitism of other insects. The name *alpina* is preoccupied for a variety of *F. adamsi* Wheeler.

24. F. rufa pratensis Retzius.

F. pratensis Retzius, Gen. & spec. ins., 1783, p. 75, ☿ ; Roger, Verz. Formic., 1863, p. 13; Ern. André, Rev. mag. zool., 1874, ser. 3, **2**, p. 184; Forel, Bull. Soc. Vaud. sci. nat., 1875, ser. 2, **14**, pt. 75, p. 58, 61; Ern. André, Spec. Hymén. Europe, 1882, **2**, pt. 14, p. 184, 189, ☿ ♀ ♂; Mayr, Fedtschenko's Turkestan. Formicid., 1877, p. 6; Lubbock, Ants, bees, wasps, ed. 5, 1882, p. 441; Forel, Ann. Soc. ent. Belg., 1886, **30**, p. 136, 138; Wasmann, Deutsch. ent. zeitschr., 1887, **31**, p. 109; Forel, Ann. Mus. St. Petersbourg, 1904, **8**, p. 385.

F. rufa Christ, Naturg. ins., 1781, p. 510, pl. 60, f. 7, ♀ ♂; Huber, Recherches moeurs fourm. indig., 1810, p. 320, ☿ ♀ ♂.

F. congerans Nylander, Acta Soc. Fennica, 1846, **2**, p. 906, ☿ ; Ibid., 1849, **3**, p. 26, 30, ♂; Förster, Hymen. stud., 1850, **1**, p. 17, ☿ ♀ ♂; Mayr, Verh. Zool. bot. ver. Wien, 1855, **5**, p. 332, ☿ ♀ ♂; Europ. Formicid., 1861, p. 46–48, ☿ ♀ ♂; F. Smith, List Brit. anim. Brit. mus., 1858, pt. 6, p. 2, pl. 3, f. 1, 7–9.

F. rufa st. *pratensis* Forel, Denks. Schweiz. gesell. naturw., 1874, **26**, p. 52, ☿ ♀ ♂.

F. pratensis Dalla Torre, Catalog. Hymen., 1893, **7**, p. 204.

F. rufa subsp. *pratensis* Ruzsky, Formicar. Imper. Ross., 1905, p. 337; Emery, Deutsch. ent. zeitschr., 1909, p. 186, ☿ ♀ ♂.

Worker. Whole body and appendages, except antennae, covered with rather short but dense, suberect hairs. Eyes hairy. Fundamental colors as in the typical *rufa*, but the black spot on the head is larger, the spot on the pronotum reaches the posterior border of the segment and there fuses with a black spot on the mesonotum. Legs very largely brown; gaster entirely black.

Female. Very similar to the female of the typical *rufa;* hairs sparse; eye sparsely hairy. Gaster subopaque or opaque, pubescent, brownish black except for a small basal and anal red spot.

Male. Usually, but not always distinguishable from the male of *rufa* merely by its more abundant pilosity.

Host (Temporary). *F. fusca.*

Northern and Middle Europe, Siberia, Island of Sakhalin; in Europe ranging southward to Southern Italy in the high mountains.

This subspecies prefers to nest in meadows, fields, or along the borders of woods and hedges. The nests are similar to those of *rufa* and are single or in groups, but of average smaller size.

F. rufa pratensis is, like *rufa*, a temporary social parasite on *F. fusca.* In Southern Europe it probably prefers the var. *glebaria* of this ant as a host.

25. F. rufa pratensis var. nigricans Emery.

F rufa var. *nigricans* Emery, Deutsch. ent. zeitschr., 1909, p. 187, ☿ .

Worker. Color darker than that of the typical *pratensis*, the black spots on the thorax more extensive; legs brownish black with brownish red coxae and knees.

This is a southern form occurring in the Maritime Alps, Spain, and the Apennines (Vallombrosa), according to Emery.

26. F. rufa pratensis var. truncicolo-pratensis Forel.

F. rufa st. *pratensis* var. *truncicolo-pratensis* Forel, Fourmis Suisse, 1874, p. 53; Ruzsky, Formicar. Imper. Ross., 1905, p. 348, ☿ ♀ ♂.

F. rufa pratensis var. *truncicolo-pratensis* Emery, Deutsch. ent. zeitschr., 1909, p. 187.

Worker, Female, and Male in color and pilosity forming transitions to *F. truncicola*. According to Forel, the hairs are like those of *truncicola* but the color, though variable according to the formicaries, tends to become more like that of *pratensis;* the hairs may also become shorter and less black.

The females of this form are said to be very rare (Wasmann). The nests, according to Forel, have a structure intermediate between those of *pratensis* and *truncicola*.

27. F. rufa aggerans Wheeler.

F. rufa McCook, Proc. Acad. nat. sci. Phil., 1884, p. 57–65.

F. rufa subsp. *obscuriventris* Mayr, var. *rubiginosa* Emery, Zool. jahrb. Syst., 1893, **7**, p. 644, 650, ♀ (nec ♀).

F. rufa subsp. *obscuripes* var. *rubiginosa* Wheeler, Ants, 1910, p. 202, 570, fig. 111.

F. rufa aggerans nom. nov., Wheeler, Psyche, 1912, **19**, p. 90.

Worker. Length 3.5–8.5 mm.

Head and thorax opaque, finely shagreened; mandibles delicately striated, smoother and more shining towards their bases, clypeus finely longitudinally striated. Frontal area subopaque, less shining than in the European forms. Gaster and legs opaque.

Clothed with suberect, grayish or yellowish hairs, abundant on the head, gula, thorax, gaster, and fore coxae, sparser on the tibiae. Eyes hairy. Pubescence on the gaster very fine and dense so that the character of the surface is concealed and this region has a grayish caste.

Head, thorax, and petiole rather bright red, in large specimens immaculate or with only a faint clouding of brown on the divisions of the pro- and mesonotum in smaller workers; legs and antennae dark red or brown, scapes usually paler; in small workers the whole surface of the body may be brown, with the mandibles, clypeus, and anterior portion of the head more reddish; medium sized workers intermediate in having the pro-, meso-, and epinotum, and the petiole more or less infuscated.

Female. Length 8–9 mm.

Surface of body slightly smoother and more shining than in the worker. Gaster, especially, more shining.

Pilosity as in the worker but the hairs longer and somewhat sparser. Pubescence on the gaster in fresh specimens rather dense and concealing the very shining surface but apparently very easily rubbed off. In such specimens the gaster is as smooth and shining as in the European *rufa*.

Head and thorax yellowish red, gaster black; posterior portion of head, front, middle of clypeus, borders of mandibles, posterior border of pronotum, remainder of thorax, except in some specimens, the anterolateral corners of the mesonotum, upper portion of petiole, legs, and antennae, dark brown. Wings slightly infuscated, with brown veins and stigma.

Male. Length 7–9.5 mm.

Body opaque. Head and thorax more coarsely shagreened than in the European *rufa*. Frontal area somewhat shining.

Hairs and pubescence gray, not black as in the typical *rufa* and more abundant on all parts of the body. Pubescence longer and denser on the legs and gaster so that this region is not shining. Tibiae with sparse, oblique hairs. Eyes hairy.

Deep black throughout, including the legs; genital sclerites yellowish at their bases. Wings as in the female.

Host (Temporary). Unknown, probably one of the boreal forms of *F. fusca*.

Type locality.— Colorado.

Colorado: Florissant, Lake George, Boulder, Malvern, Salida, Denver, Colorado Springs, Buena Vista (Wheeler); Breckenridge, West Cliff (P. J. Schmitt); Fort Collins (C. P. Gillette); Ute Pass, South Park, Leadville (H. C. McCook); Steamboat Springs (T. D. A. Cockerell).

Montana: Nigger Hill, Powell County (W. M. Mann).

New Mexico: Pecos (T. D. A. Cockerell); Beulah (Mrs. W. P. Cockerell); Barela Mesa (Miss Anna Gohrman).

Utah: Lehi (W. A. Hooker).

Texas: Fort Davis (Wheeler).

Idaho: Lewiston, Market Lake, Collins, and Moscow (J. M. Aldrich).

Wyoming: Carbon County.

North Dakota: Jamestown (H. C. McCook).

Alberta; Medicine Hat (J. C. Bradley).

Emery cites this form from Nebraska, Colorado, and Dakota but I prefer to regard Colorado as the type locality. The female mentioned by Emery from Louisiana probably does not belong here. Emery's description is unfortunately very brief and he does not sufficiently differentiate this form from *obscuripes*. Forel states emphatically that *obscuripes* has only pubescence on its tibiae. I find that all specimens of *aggerans* have prominent oblique hairs on the tibiae, though sometimes few in number. This and the opaque, more pubescent, grayish gaster, and much more abundant pilosity on the body in general serve to distinguish the worker of *aggerans*.

F. aggerans is undoubtedly the common "thatching ant" of the Western States. It constructs a nest very much like that of *F. rufa pratensis* in Europe, at altitudes varying from 6,000–8,000 ft. The vegetable débris used in the construction of the mounds is often very coarse. McCook mentions this ant or possibly the true *obscuripes* as occurring at Iowa Gulch near Leadville, Colo., at an elevation of 11,300 ft.

28. F. RUFA AGGERANS var. MELANOTICA Emery.

F. rufa obscuriventris var. *melanotica* Emery, Zool. jahrb. Syst., 1893, **7**, p. 644, 650, ♀ ; Wheeler, Ants, 1910, p. 570.

WORKER. Length 4–8 mm.

Differing from the worker of the typical *aggerans* in color and pubescence. The thorax of even the large workers has a strong tendency to infuscation, so that in some colonies such individuals are black with a red head, which is sometimes clouded with brown in the ocellar, occipital, and frontal region. The pilosity is the same as in the typical *aggerans*, but the pubescence on the gaster is more dilute, so that this region is more shining and the shagreened surface is visible.

FEMALE. Length 8 mm.

Resembling the female of *aggerans*, but the infuscation of the thorax is more extensive, involving also the pronotum. Gaster very smooth and shining.

MALE. Length 8 mm.

Differing from the male of *aggerans* only in having the gaster more shining, owing to the sparse pubescence. Frontal area scarcely shining. Eyes hairy.

TYPE LOCALITY.— Wisconsin.

Wisconsin: Dodges' Corner, Waukesha Co., Waupaca (C. E. Brown); Prairie du Chien (H. Muckermann).

Illinois: Rockford (Wheeler); Algonquin (W. A. Nason).

South Dakota: Harding County (S. S. Visher).

Nebraska (Willy).

Wyoming: Medicine Bow (F. M. Chapman).

Oregon: (Amer. Mus. Nat. Hist. Coll.).

Washington: Olympia (T. Kincaid); Pullman (W. M. Mann); Puget Sound (Leconte).

British Columbia: Vernon (W. H. Britton).

I have described the female and male from specimens taken at Pullman, Wash., by Mr. W. M. Mann. I have seen the nests of this

form only in Illinois. These are much smaller than the nests of the typical *aggerans*, being rarely more than a foot or 18 inches in diameter. They are built of coarse materials in open grassy fields. Apparently *melanotica* in its deeper pigmentation and its fondness for such situations and for lower altitudes bears about the same relation to *aggerans* that *F. pratensis* does to the typical *rufa* in Europe.

29. F. RUFA OBSCURIPES Forel.

F. rufa st. *obscuripes* Forel, Ann. Soc. ent. Belg., 1886, **30**, C. R. p. xxix; Ibid., 1904, **48**, p. 152, ♀ ; Wheeler, Ants, 1910, p. 570.

F. rufa obscuriventris Mayr var. *obscuripes* Emery, Zool. jahrb. Syst., 1893, **7**, p. 644, 650, ♀ .

WORKER. Length 3.8–8 mm.

Similar to the typical *rufa* of Europe, but the large individuals have the head and thorax of a lighter red and entirely or almost entirely without dark spots on the head and thorax, whereas the legs and petiole are blackish brown or reddish brown. The small workers are of a much darker color and have the head and thorax spotted with brown. Gaster subopaque, deep brown or blackish, covered with slightly longer and denser, gray pubescence than the typical *rufa*, while the erect hairs on the gaster, head, and thorax are rather sparse, inconspicuous and less numerous than in the true *rufa* and the subspecies *pratensis*. Tibiae without erect or suberect hairs and covered merely with appressed pubescence. Gula with a few erect hairs. Eyes hairy.

HOST (TEMPORARY). Unknown; probably one of the boreal forms of *F. fusca*.

TYPE LOCALITY.— Wyoming: Green River (S. H. Scudder).

Wyoming: Elk Creek (R. P. Currie).

Montana: (Amer. Mus. Nat. Hist. Coll.).

Washington: Loon Lake (S. Henshaw); Rock Lake (A. L. Melander).

Colorado: Boulder (Wheeler).

Arizona: Thatcher (R. V. Chamberlin).

British Columbia: Golden (W. Wenman); Summerland (W. H. Britton).

This form is imperfectly known. Forel insists on regarding it as a subspecies, and he may be right, but it should be pointed out that the absence of erect hairs on the tibiae is perhaps not as strong a character as he supposes. One often finds workers of what I regard as Emery's *rubiginosa* (*aggerans*) that have very few suberect hairs on the tibiae.

The specimens from Boulder, Colorado, represent a series from a single colony, the largest with a few suberect hairs on the tibiae, the medium sized and small workers without any, so that one is in doubt as to which subspecies they belong. I have not seen females and males of the true *obscuripes* and am inclined to believe that further study may show that both *obscuripes* and *aggerans* are really the same rather variable subspecies. Both build the same type of nest, a dome-shaped mound of twigs and other vegetable débris, often very coarse and very much like the nests of the European *pratensis* in size and shape. *Formica obscuripes*, like the typical *aggerans*, is peculiar to British Columbia and the Northwestern States, being best represented at altitudes between 5,000 to 8,000 ft.

30. F. RUFA OBSCURIPES var. WHYMPERI Forel.

F. rufa st. *obscuripes* var. *whymperi* Forel, Ann. Soc. ent. Belg., 1904, **48**, p. 152, ☿ .

F. rufa obscuripes var. *whymperi*, Wheeler, Ants, 1910, p. 570.

WORKER. With the color and aspect of the darker forms of *F. pratensis* of Europe; front, vertex, occiput, and dorsum of pronotum and mesonotum blackish; with the same pubescence and sculpture, but with the sparse pilosity of *obscuripes;* tibiae without suberect hairs.

TYPE LOCALITY.— British Columbia: Vermillion Pass, 5,000–6,500 ft. (E. Whymper).

This form seems to have been described from a single worker. I have not been able to recognize it among the material collected in British Columbia by J. C. Bradley and W. Wenman.

31. F. TRUNCICOLA TRUNCICOLA Nylander.

F. truncicola Nylander, Acta Soc. Fennica, 1846, **2**, p. 907, ☿ ♀; Ibid., 1849, **3**, p. 26, 29, ♂; Förster, Hymen. stud., 1850, **1**, p. 21, ♀ ♂ (nec ☿); Schenck, Jahrb. Ver. nat. Nassau, 1852, **8**, p. 33, 139, 145, ☿ ♀ ♂; Stettin. ent. zeit., 1853, **14**, p. 160; Mayr, Verh. Zool. bot. ver. Wien, 1855, **5**, p. 334, ☿ ♀ ♂; Europ. Formicid., 1861, p. 46, 48, ☿ ♀ ♂; Forel, Bull. Soc. Vaud. sci. nat., 1875, ser. 2, **14**, p. 58; Mayr, Fedtschenko's Turkestan. Formicid., 1877, p. 6; Ern. André, Spec. Hymen. Europe, 1882, **2**, pt. 14, p. 183, 187, 189, ☿ ♀ ♂; Dalla Torre, Catalog. Hymen., 1893, **7**, p. 213; Bingham, Fauna Brit. Ind., 1903, **2**, p. 334; Forel, Ann. Mus. St. Petersbourg, 1904, **8**, p. 385; Ruzsky, Formicar. Imper. Ross., 1905, p. 330, fig. 63, 64.

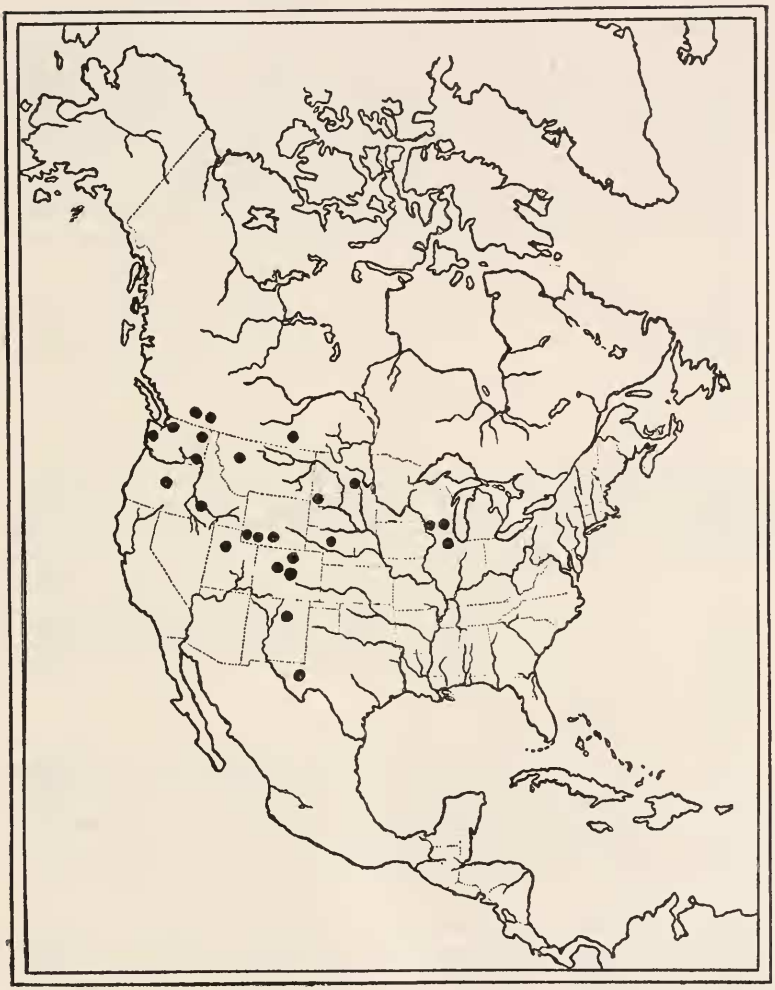

FIG. 2.— Distribution of the Nearctic forms of *Formica rufa*.

F. rufa st. *truncicola* Forel, Denks. Schweiz. gesell. naturw., 1874, **26**, p. 52, ☿ ♀ ♂.

F. rufa subsp. *truncicola* Emery, Deutsch. ent. zeitschr., 1909, p. 187.

Worker. Length 3.5–8.5 mm.

Closely resembling *F. rufa* in form, but pro- and mesonotum often somewhat less convexed and rounded. Petiole broad, compressed anteroposteriorly, with sharp border, often distinctly notched above. Body, including the gaster, opaque, finely shagreened; mandibles, clypeus, frontal area, and in large workers the anterior part of the head, shining; mandibles finely and superficially striated.

Hairs short, golden yellow, very abundant, covering the body and legs; antennal scapes also often with some oblique or suberect, short hairs. Eyes hairy. Pubescence very short and rather sparse.

Bright red or yellowish red; funiculi and tibiae brown; gaster, with the exception of the anal region and a large yellowish red spot at the base, brownish black. In small workers the vertex and a spot on the pro- and mesonotum are brown, and occasionally the vertex may have a brown spot in large individuals.

Female. Length 8–9 mm.

In sculpture, pilosity, and color very similar to the worker. A spot on the vertex, two or three longitudinal stripes on the mesonotum, the scutellum and gaster, with the exception of the basal half of the first segment, tibiae, and antennal funiculi brown. More rarely the head and thorax, with the exception of the scutellum, are entirely red; sometimes each of the gastric segments is red at the base, at least on the ventral side. Gaster less shining than in the typical *rufa*, more shining than in *pratensis*. Hairs abundant, delicate, yellow, varying considerably in length. Wings infuscated towards their bases, with brown veins and stigma.

Male. Length 7–9 mm.

Differing from the male of *rufa* and *pratensis* in being much more hairy. Hairs and pubescence yellowish or grayish, the latter rather long on the gaster, legs, and funiculi. Eyes hairy. Frontal area shining. Head, thorax, and antennae black; petiole and gaster often more brownish black; tips of mandibles, genitalia, and legs, except their coxae, reddish yellow. Wings colored as in the female.

Host (Temporary). *F. fusca.*

North and Middle Europe, Alps, Caucasus, Siberia, Turkestan, Cashmir; Lahoul, on the frontier of Thibet, Eastern Buchara; Island of Sachalin.

Although Forel, Emery, and several other recent authors have regarded *F. truncicola* as a mere subspecies of *rufa*, it seems to me to rank as an independent species. This has, indeed, been the view of

most of the older authorities, as will be seen by consulting the synonymy, and Emery himself says: "*F. rufa truncicola* dürfte eher als besondere Art betrachtet werden." The difference is more apparent in the habits, perhaps, than in structure, for *truncicola* does not build large independent mound-nests like *F. rufa, pratensis, aggerans, obscuripes* and their varieties, but nests about stumps and logs or the roots of plants, though it banks these with vegetable detritus. The same habit holds of the forms which I regard as American subspecies and varieties of *truncicola*.

Like *rufa*, the *F. truncicola* queen establishes her colony by temporary parasitism on *F. fusca*, as Wasmann has shown.

32. F. TRUNCICOLA TRUNCICOLA var. YESSENSIS Forel.

F. rufa race *truncicola* var. *yessensis* Forel, Mitth. Naturh. mus. Hamburg, 1901, **18**, p. 66, ♀.

F. rufa truncicola var. *yessensis* Ruzsky, Formicar. Imper. Ross. 1905, p. 335; Emery, Deutsch. ent. zeitschr., 1909, p. 188.

WORKER. Differing from the typical *truncicola* in having the basal surface of the epinotum somewhat shorter and more convex and in the sparser, shorter pilosity. There are very few hairs on the antennal scapes and none on the extensor surfaces of the tibiae. The flexor surfaces bear the usual series of oblique bristles.

Japan: Serachi, Province Ishikari, Island of Yesso.
Siberia: Tomsk and Tobolsk, according to Ruzsky.

33. F. TRUNCICOLA TRUNCICOLA var. SINENSIS, var. nov.

WORKER. Length 4–8 mm.

Opaque; mandibles and clypeus slightly shining, delicately longitudinally striate; frontal area and frontal groove very smooth and shining.

Erect hairs golden yellow, less abundant than in the typical *truncicola*, absent on the upper surface of the head and clypeus, middorsal region of the pro- and mesonotum and flexor surfaces of the tibiae, long on the gula, epinotum, fore coxae, and gaster. Eyes hairless. Pubescence fine and rather sparse, most easily visible on the epinotum and on the gaster where it is sufficiently abundant to produce a grayish tinge, extremely fine on the antennae, head, pro- and mesonotum.

Head, thorax, petiole, and legs deep, dull red; mandibles and front of head a little darker; cheeks and clypeus a little paler; smallest

workers with the upper surface of the head and a spot on the pro- and mesonotum fuscous. Gaster black, anal region, and often also in large individuals, the base of the first segment, dull reddish.

Described from numerous workers from Chung-King, Western China, (Amer. Mus. Nat. Hist. Coll.).

This variety is evidently very close to *yessensis* Forel, but the antennal scapes are very smooth and without any traces of oblique hairs, the color is very deep and the distribution of the hairs is peculiar, especially their absence on the whole upper surface of the head and clypeus and their nearly complete absence on the convex portions of the pro- and mesonotum.

34. F. TRUNCICOLA DUSMETI Emery.

F. rufa dusmeti Emery, Deutsch. ent. zeitschr., 1909, p. 188, ☿ ; Forel, Rev. Suisse Zool., 1911, **19**, p. 457, 458.

WORKER. Resembling the typical *truncicola* in its light red coloration; head and thorax red, without spots or with a blackish spot on the front; gaster quite opaque, black, with red basal spot; antennae and legs brown, scapes and femora red. Head and thorax entirely without erect hairs; eyes hairless; gaster covered with rather abundant short hairs.

This subspecies, based on three specimens collected by Dusmet at Peñalosa, in Spain, has recently been taken in Norway by Forel. According to Emery, it is very similar to the North American *F. truncicola integra* Nyl.

35. F. TRUNCICOLA INTEGROIDES Emery.

F. rufa subsp. *obscuriventris* Mayr. var. *integroides* Emery, Zool. jahrb. Syst., 1893, **7**, p. 649, ♀, Wheeler, Ants, 1910, p. 570.

WORKER. Length 3.5–8 mm.

Body, including the mandibles and clypeus, opaque. Mandibles densely and sharply striate, with scattered punctures. Frontal area smooth, only slightly shining. Clypeus sharply carinate. Thorax and petiole much as in the typical *truncicola*, but base of epinotum somewhat more convex.

Pubescence yellowish, dense, distinct on the head and thorax, long and conspicuous on the gaster, sparse on the legs. Hairs golden yellow, very sparse on the upper surface of the head, thorax, and petiole,

more abundant on the gula, short and appressed on the extensor surfaces of the tibiae. Eyes hairy.

Light yellowish red; mandibles, legs, and antennae darker, femora more brownish; gaster dark brown, with yellowish anal region. Small workers sometimes have the top of the head and thorax spotted with pale brown.

Female. Length 8 mm.

Head, excluding the mandibles, as broad as long, with very straight posterior and lateral borders, the latter strongly converging anteriorly; posterior corners of head rather sharp. Antennal scapes reaching about twice their greatest diameter beyond the posterior corners.

Sculpture, pilosity, and color as in the worker. Petiole, thoracic dorsum, and base of gaster with a number of pale, erect hairs; pubescence on the head and thorax even longer and more conspicuous than in the worker. Gaster not shining. Mesonotum with three elongate fuscous spots; funiculus, except its base, the metanotum, and posterior portion of scutellum, blackish. Wings opaque gray, with brown veins and stigma.

Host (Temporary). Unknown.

Type locality.— California: Coastal mountains.

California: San Gabriel Mountains near Claremont (C. F. Baker); Felton, Santa Cruz Mountains 300–500 ft.; Santa Cruz Beach, Giant Forest (J. C. Bradley); Loma Prieta, Santa Cruz Mountains 3,800 ft. (V. L. Kellogg); King's River Canyon (H. Heath); Corte Madera Creek (W. M. Mann); Pine Lake (J. D. Johnson).

I have redescribed the worker of this form from cotype specimens given me by Mr. Pergande. Although, as Emery states, it is allied to *integra*, it is not a variety of *obscuriventris*, as he believed. He records it from California and Nebraska, but I have seen the form only from the coastal mountains of the former state and regard this as the type locality. It is replaced to the eastward in the Rocky Mountains by the two closely allied varieties described below, which differ from it mainly in pilosity.

According to a statement (*in litteris*) of Prof. Harold Heath, *F. integroides* inhabits open woods and accumulates large quantities of vegetable detritus about the stumps and logs in which it nests. In these particulars its habits are very similar to those of the European *truncicola* and our eastern subsp. *integra*.

F. TRUNCICOLA INTEGROIDES var. COLORADENSIS, var. nov.

F. rufa subsp. *integra* var. *coloradensis* Wheeler, Ants, 1910, p. 570.

WORKER. Length 4–9 mm.

Differing from the typical *integroides* in its somewhat greater average size, in having more shining mandibles and frontal area, and in the pilosity, which is pale yellowish and as abundant as in the European *truncicola*, covering all parts of the body, except the antennae. The scapes often have a few scattered suberect hairs and the eyes are distinctly hairy. Oblique hairs on the extensor surfaces of the tibiae as long as those on the flexor surfaces. The pubescence is also long and abundant, conspicuous on the head and thorax as well as the gaster. Small and large workers are of the same color.

Head, thorax, petiole, legs, and antennae bright red, mandibles darker; gaster dark brown, with red anal region and often with a small red spot at the base of the first segment.

FEMALE. Length 8–10 mm.

Mandibles more opaque and more coarsely sculptured than in the worker.

Pilosity and pubescence similar to those of the worker, but the former whitish, more delicate and less conspicuous on the thorax. Pubescence on the gaster more dilute so that this region is slightly lustrous or shining and not opaque as in the worker.

Color like that of the worker; mesonotum with three elongate brown spots; funiculi, metanotum, and posterior border of scutellum infuscated; mandibles deep red. Wings grayish hyaline, distinctly infuscated towards the base.

TYPE LOCALITY.— Colorado: Florissant, 8,100 ft.

Colorado: Wild Horse and Woodland Park, 8,500 ft. (Wheeler); Ward, 9,000 ft. (T. D. A. Cockerell); Boulder, Breckenridge (P. J. Schmitt).

New Mexico: Pecos, Beulah, 8,000 ft. (T. D. A. Cockerell and Mrs. W. P. Cockerell).

Idaho: Blackfoot, Market Lake (J. M. Aldrich).

Of all our forms this is most like the typical European *truncicola* in pilosity. It differs, however, in color, the red parts being lighter and the gaster with an inconspicuous yellow base and a peculiar bluish bloom, due to the dense gray pubescence covering a blackish surface. Its habits are similar to those of the European species since it nests under and in stumps and logs, filling their interstices with vegetable débris, but the colonies are much larger than those of the European

type and, according to my observations, are confined to pine woods and to higher altitudes. The queens were taken in the nests during the latter half of July.

36. F. TRUNCICOLA INTEGROIDES var. HAEMORRHOIDALIS Emery.

F. rufa subsp. *integra* var. *haemorrhoidalis* Emery, Zool. jahrb. Syst., 1893, **7**, p. 652, ☿ ; Wheeler, Ants, 1910, p. 570.

WORKER. Length 4–9 mm.

In structure, sculpture, and color like the preceding variety and the typical *integroides*, but differing from both in having no erect hairs on the head, thorax, petiole, and legs, with the exception of a few on the clypeus and the row of bristles on the flexor surfaces of the tibiae. Suberect hairs on the gaster sparse. The pubescence is the same as in the two preceding forms and the gaster has the same appearance of being covered with a bluish bloom. Eyes hairless. Mandibles and frontal area rather shining. The small workers do not differ in color from the large ones.

FEMALE. Length 9–10 mm.

Similar to the female of *coloradensis* but lacking the erect hairs on the head, thorax, petiole, and legs and the dark spots on the thorax. Wings grayish hyaline, infuscated towards the base, with brown veins and stigma.

MALE. Length 8 mm.

Mandibles rather broad, edentate. Petiole thick, but with a compressed, thin margin, broadly excised in the middle.

Head and thorax opaque; gaster glossy; frontal area slightly shining. Body and legs covered with grayish pubescence which is longest on the thorax and gaster. The erect hairs are very short, but moderately abundant on the head, thorax, and gaster. Tibiae with short, scattered, suberect hairs.

Head, thorax, gaster, and antennae black; tips of mandibles, genitalia and legs testaceous or yellowish, femora and tarsi more or less infuscated. Wings as in the female.

TYPE LOCALITY. — Colorado.

Colorado: Florissant 8,100 ft., Woodland Park 8,500 ft., Ute Pass, Manitou, Garden of the Gods (Wheeler).

Dakota (Emery).

Idaho: Moscow Mts. (J. M. Aldrich).

Nevada: Ormsby County (C. F. Baker).

Washington: Yakima River opposite Ellensburg (S. Henshaw).

This variety lives in the same localities and builds nests very similar

to those of the var. *coloradensis*. It is in fact, merely a hairless variety of *integroides* and not a variety of *integra*, which is confined to the Eastern States and has a different kind of pubescence and a very hairless male. The typical *integroides*, and the vars. *coloradensis* and *haemorrhoidalis* have exactly the same macroscopical appearance and differ essentially only in pilosity. They represent in the west the two eastern subspecies *integra* and *obscuriventris*.

37. F. TRUNCICOLA MUCESCENS, subsp. nov.

WORKER. Length 3.5–7 mm.

Head large, excluding the mandibles, about as broad as long, a little broader behind than in front, with straight or very feebly excised posterior border and slightly convex sides. Mandibles 8-toothed. Clypeus strongly carinate and convex at base, its anterior border broadly rounded, not angular. Frontal carinae moderately diverging. Antennae slender, basal funicular joints longer and more slender than the penultimate joints. Pro- and mesonotum not very convex, the mesoëpinotal impression rather shallow, the epinotum with subequal base and declivity, the former convex, the latter feebly concave. Petiole rather thick and narrow, cuneate in profile, convex in front and behind, with rather sharp superior border, which is entire and somewhat angularly rounded in the middle.

Subopaque; mandibles, clypeus, front, and sides of head more shining, the mandibles finely striatopunctate. Frontal area very smooth and shining. Gaster opaque.

Hairs bright golden yellow, short and very sparse on the front, more abundant on the pro- meso- and epinotum, gula, petiolar border, and gaster; absent on the scapes and legs. Pubescence grayish, very dense and rather long on the gaster, well developed but sparser on the head and thorax, especially on the epinotum; very sparse and inconspicuous on the legs. Eyes not hairy.

Light red; mandibles, petiole, antennae, and legs darker and more brownish red; gaster dark or blackish brown, but appearing drab on account of the pubescence; anal region red. Small workers with the upper surface of the thorax and sometimes also the vertex, more brownish red.

FEMALE. Length 6.5–8 mm.

Body small. Head broader than the thorax; eyes rather small. Petiole much as in the worker but with blunter border.

Mandibles, frontal area, and legs shining, remainder of body more opaque than in the worker.

Erect hairs lacking on the body, except on lower surface of petiole, venter, and tip of gaster. There are occasionally a few hairs on the

front. Tibiae with oblique and rather long pubescence on their flexor surfaces. Pubescence gray, long, dense, and suberect on the gula, upper surface of the head and thorax, appressed on the antennal scapes and gaster. The latter region is slightly more lustrous than in the worker.

Head, thorax, and petiole sordid brownish yellow; mandibles, ocellar region, posterior corners of head, posterior border of pronotum, mesonotum, scutellum, metanotum, mesopleurae, legs, antennae, and sometimes also the upper border of the petiole, brown; gaster blackish brown, with slightly reddish anal region. Wings distinctly infuscated, scarcely paler towards their tips; veins and stigma brown.

Male. Length 7–8 mm.

Mandibles edentate, clypeus convex, carinate, transversely impressed behind; head rather broad; eyes large. Petiole low and thick with rounded, entire superior border.

Mandibles and frontal area shining; head and thorax opaque; gaster, pleurae, legs, and genitalia lustrous.

Hairs yellowish, very short, erect, and rather abundant on the head and thorax, sparser and more appressed on the upper surface of the gaster, absent on the legs. Pubescence grayish, moderately developed, most distinct on the gaster.

Black; even the tips of the mandibles not paler; genital sclerites black or castaneous, with yellowish insertions. Wings infuscated as in the female.

Type locality.— Colorado: Colorado Springs. (Wheeler).

Colorado: Colorado City, Malvern, Wild Horse, Manitou (Wheeler); West Cliff (P. J. Schmitt).

This form is rather puzzling. It is perhaps a distinct species, but I have preferred to regard it provisionally as a subspecies of *truncicola*. The small, almost hairless and peculiarly colored females enable one to recognize the species better than the workers, which at first sight resemble those of *F. truncicola integroides* vars. *haemorrhoidalis* and *coloradensis*. The new form differs from these varieties, however, in pilosity and pubescence, and in the smaller average size of all three phases. The males are peculiar in being almost entirely black, even to the greater portion of the genital appendages.

I found several colonies of this ant both in 1903 and 1906, each containing many females and males. They were nesting in open places, at altitudes of about 5,000–7,000 feet, under stones banked with vegetable detritus.

38. F. TRUNCICOLA INTEGRA Nylander.

F. integra Nylander, Ann. sci. nat. Zool., 1856, ser. 4, **5**, p. 62 *nota*, ☿ ; F. Smith, List Brit. anim. Brit. mus., 1858, pt. 6, p. 54, ☿ ; Dalla Torre, Catalog. Hymen., 1893, **7**, p. 200.

F. integra var. *similis* Mayr, Verh. Zool. bot. ver. Wien, 1886, **36**, p. 425, ☿ ♀ ♂.

F. rufa subsp. *integra* Emery, Zool. jahrb. Syst., 1893, **7**, p. 652, pl. 22, figs. 4, 8; Wheeler, Bull. Amer. mus. nat. hist., 1906, **22**, p. 67; Ants, 1910, p. 204, 570, fig. 112.

WORKER. Length 4–8 mm.

Closely resembling the worker of *F. truncicola integroides* var. *haemorrhoidalis* in lacking the pilosity on the head, thorax, petiole, and legs, but the petiole is broader and with a sharper border, the surface of the body is opaque, except the mandibles, frontal area, and gaster which are all somewhat shining. Mandibles sharply, clypeus less distinctly striated.

Pubescence very fine, visible on the head, thorax, and appendages, but sparse on the gaster so that the surface is visible. Hairs on the gaster very sparse, often more abundant on the venter and tip. Eyes hairless.

Head, thorax, petiole, and appendages bright red, mandibles darker. Gaster black, only the anal region and extreme base of first segment slightly tinged with red. The red portions of small workers rarely somewhat darker above than in large individuals.

FEMALE. Length 8–9 mm.

Closely resembling the worker in sculpture, color, and pilosity. Pubescence on gaster denser so that this region is subopaque or but slightly shining. Mesonotum immaculate or with very faint brownish indications of the three spots. Metanotum black, scutellum, with the exception of its anterior border, infuscated. Wings grayish hyaline, infuscated at the base, with brown veins and stigma.

MALE. Length 7–8 mm.

Mandibles broad, sometimes indistinctly dentate. Eyes rather large. Petiole compressed, with rather sharp, broadly excised superior border.

Head and thorax opaque, frontal area strongly, gaster and mandibles more feebly, shining.

Erect hairs absent on head, thorax, gaster, and appendages. Pubescence grayish, rather abundant but fine, most conspicuous on the thorax, legs, and gaster. Eyes hairless.

Black; antennae dark brown; tips of mandibles reddish. Legs and genitalia yellow, coxae infuscated. Wings somewhat more heavily and uniformly infuscated than in the female.

Host (Temporary). *F. fusca* var. *subsericea*.

Maine: Lower Goose Island, Casco Bay (Wheeler); Monmouth (Frost).

New Hampshire: Littleton, Hannover (C. M. Weed); Durham (W. F. Fiske); Mt. Moosilauke, 1,700 ft. (Wheeler).

Massachusetts: Wellesley (A. P. Morse), Forest Hills (Wheeler); W. Springfield (Geo. Dimmock).

Connecticut: Colebrook (Wheeler).

New York: High Bridge; West Farms (J. Angus); Ashokan, Bergen Beach (G. v. Krochow); Mosholu, Bronxville (Wheeler); Long Beach, Long Island.

New Jersey: Jamesburg, Lakehurst (Wheeler); Clementon.

Pennsylvania: Enola, Frankford, Lawndale; West Chester (J. C. Bradley).

North Carolina: Black Mts. (W. Beutenmüller).

Georgia: Atlanta, Stone Mt. (J. C. Bradley).

Indiana: Camelton, and Wyandotte (W. S. Blatchley).

Illinois: Rockford (Wheeler).

South Dakota; Hill City (Th. Pergande).

Michigan: Isle Royale (H. A. Gleason).

Alabama: Cullman (P. J. Schmitt).

Nova Scotia: Bedford (W. Reiff); Digby (J. Russell).

The specimens from northern localities like Nova Scotia, Isle Royale, and Northern Illinois have the red parts darker and somewhat clouded with fuscous and the pubescence on the gaster even sparser than in the typical form so that this region is more shining, but with the material on hand it hardly seems advisable to regard these as representing a distinct variety.

This ant, which occupies similar stations in the Eastern States to those inhabited by *integroides* in the West, has also very similar habits, living in huge colonies in rather rich, open woods in hilly regions. The nests are built in stumps and logs and under stones, and resemble those of the European *truncicola*, but are on a larger scale. A single colony often occupies a number of nests covering a considerable area. The winged forms make their appearance in August.

39. F. truncicola obscuriventris Mayr.

F. truncicola var. *obscuriventris* Mayr, Verh. Zool. bot. ver. Wien, 1870, **20**, p. 951, ♀ ; Ibid., 1886, **36**, p. 426; Dalla Torre, Catalog. Hymen., 1893, **7**, p. 214.

F. rufa subsp. *obscuriventris* Emery, Zool. jahrb. Syst., 1893, **7**, p. 649; Wheeler, Ants, 1910, p. 570.

F. dryas Wheeler, Bull. Amer. mus. nat. hist., 1905, **21**, p. 268, ☿ ♀.

Worker. Length 3.5–7.5 mm.

Averaging smaller than the preceding subspecies. Base of epinotum usually convex and rounded. Petiole moderately broad, strongly compressed anteroposteriorly, its dorsal border thin and sharp, entire and produced upward in the middle.

Opaque; mandibles and clypeus slightly shining, longitudinally striate, frontal area very smooth and shining. Gaster subopaque or slightly shining, finely shagreened and punctate.

Hairs and pubescence yellowish, the former short, erect, as abundant as in the typical *truncicola*, covering all parts of the body except the antennae; scapes sometimes with a few scattered hairs on their posterior surfaces. Eyes hairy. Pubescence distinct and rather dense on the head and thorax, sparser and finer on the gaster so that the surface is clearly visible.

Deep red, when mature; mandibles and corners of clypeus darker; gaster black, with the anal region and sometimes also a small spot at the base of the first segment reddish. Large workers very rarely, smallest workers somewhat more frequently, with a brownish cloud in the region of the ocelli and on the pro- and mesonotum.

Female. Length 7–8 mm.

Surface of body more shining than in the worker, especially the gaster, which is as glabrous and shining as in the female of the typical *rufa*. Mandibles coarsely striatopunctate, head and thorax very finely and densely punctate; clypeus, front, and anterior portion of mesonotum with several large, elongate punctures.

Hairs longer and more flexuous than in the worker, especially on the top of the head, gula, thoracic dorsum, and tibiae, varying greatly in length, sparse on the pleurae and absent on the gaster, except on the ventral surface and tip. Antennal scapes often with a row of long, flexuous, erect hairs along their posterior surfaces. Eyes hairy. Pubescence yellowish, abundant and rather dense on the thorax and legs; sparse on the gaster.

Deep red, three elongate spots on the mesonotum, the posterior portion of the scutellum, the metanotum, and the gaster black. Tibiae, tarsi, and funiculi dark brown. Anal region sometimes reddish; first segment often with a yellowish red spot at the base. Wings strongly infuscated, with paler tips, brown veins and stigma.

Male. Length 8 mm.

Mandibles edentate, rather narrow. Eyes large. Petiole more compressed anteroposteriorly than in the other subspecies, its border rather sharp and not excised.

Pilosity and pubescence yellowish, abundant, the former suberect, absent on the upper surface of the gaster, which is covered with rather long, appressed pubescence. Legs covered with short, suberect hairs. Eyes hairy.

Head and thorax, including the frontal area, opaque; gaster somewhat shining.

Black; legs and genitalia yellow, coxae and bases of the femora dark brown. Wings infuscated as in the female.

Host (Temporary). *F. fusca* var. *subsericea*.

Type locality.— Connecticut: (Mayr).

Massachusetts: Stony Brook Reservation, Blue Hills, near Boston, Ellisville (Wheeler); Wellesley (A. P. Morse).

Maine: Sebascodegan Island, Casco Bay (Wheeler).

New York: Saugerties (G. v. Krochow); Ithaca (Cornell Univ. Coll.).

New Jersey (Mayr).

District of Columbia: Washington (A. Forel).

Virginia (Mayr).

Indiana: Culver, Tippecanoe Lake (W. S. Blatchley).

Illinois: Rockford (Wheeler).

Wisconsin: White Fish Bay, near Milwaukee (Wheeler).

Colorado: Florissant (Wheeler); Flagstaff Mt., Boulder (T. D. A. Cockerell).

British Columbia: Carbonate, Ravelstoke (J. C. Bradley); Golden (W. Wenman).

Ontario: Toronto (R. J. Crew).

This ant was originally described from Connecticut, but in a later paper (1886) Mayr cited it from several of the Atlantic States and also from Colorado, California, New Mexico, and Arizona. As it is very rare in Colorado, and as I have never received it from other Western States, I believe Mayr must have confounded it with specimens of *F. rufa aggerans*. This would be easy for large greasy specimens of *aggerans* are very similar to large workers of *obscuriventris*. In fresh specimens, however, the gaster of the latter has a very different appearance, being much as in *melanotica*, but it is readily distinguished from this form by the uniform deep red color of the head, thorax, petiole, and legs.

F. obscuriventris nests under large stones in open woods, often banking the edges of the stones with vegetable débris. The colonies are much smaller than those of *integra*, and *integroides* and rarely extend over more than one nest. Many queens are retained in the

nest and these are often very imperfectly deälated. As early as April 3 I have found many perfectly winged queens as well as several with the wings more or less gnawed off, in various colonies near Boston. These queens had evidently been retained by the maternal colony or adopted after leaving other colonies on their nuptial flight. Tanquary and I have recently shown that the queens of this ant establish new colonies through temporary parasitism on *F. fusca* var. *subsericea*.

40. F. TRUNCICOLA OBSCURIVENTRIS var. GYMNOMMA Wheeler.

F. dryas var. *gymnomma* Wheeler, Bull. Amer. mus. nat. hist., 1905, **21**, p. 269, ☿.

F. rufa subsp. *obscuriventris* var. *gymnomma* Wheeler, Ants, 1910, p. 570.

WORKER. Length 3.5–7.5 mm.

Differing from the typical *obscuriventris* only in having the eyes hairless and in having the erect hairs on the body less abundant, especially on the upper surface of the head.

TYPE LOCALITY.— New York: Cold Spring Harbor, Long Island, (Wheeler).

Massachusetts: Wellesley (Wheeler).

Georgia: Clayton, 2,000–3,700 ft. (W. T. Davis).

Illinois: Rockford (Wheeler).

41. F. URALENSIS Ruzsky.

F. uralensis Ruzsky, Arb. Ges. naturf. Kasan, 1895, **28**, p. 13, ☿ ♀ ♂; Berlin. ent. zeitschr., 1896, **41**, p. 69; Formicar. Imper. Ross., 1905. p. 348, fig. 66; Emery, Deutschr. ent. zeitschr., 1909, p. 189.

WORKER. Length 5–8 mm.

Head as broad as long, but little narrower in front than behind. Frontal carinae strongly diverging. Clypeus strongly carinate, with produced, angular, anterior margin. Antennae robust, the seapes short and thick. Petiole rather broad, compressed anteroposteriorly, with sharp, rounded, entire border.

Opaque; mandibles subopaque, densely striatopunctate. Sides of head glossy. Frontal area opaque.

Pilosity of the whole body very sparse, tibiae without oblique or suberect hairs. Gula with a few erect hairs. Pubescence yellowish, fine and sparse on the gaster and legs, denser on the cheeks and thorax. Eyes hairless.

In color resembling the darkest forms of *F. rufa pratensis*, but the

Fig. 3.— Distribution of the Nearctic forms *of Formica truncicola.*

whole of the head black, except the mandibles and a spot on the gula, which are red. Pro- and mesonotum with a black spot as in *pratensis*. Gaster black, with the base of the first segment reddish yellow. Antennae and legs brown.

FEMALE. Length 8.5–10 mm.

Antennae shorter and thicker than in the worker. Head, excluding the mandibles, a little broader than long.

Body densely punctate, head and thorax more coarsely, gaster more finely; head and thorax opaque, except the mandibles, which are coarsely striatopunctate. Clypeus delicately longitudinally striate. Gaster somewhat shining.

Pilosity pale, sparse, and somewhat longer, pubescence even sparser and more indistinct than in the worker.

Dark brown or black, mandibles except their borders, anterior portion of pronotum, inferior pleurae, venter and base of first gastric segment yellowish or reddish. Legs brown or blackish brown, coxae reddish. Wings not infuscated but merely tinged with yellowish at their bases. Veins and stigma brown.

MALE. Length 9–11 mm.

Mandibles tridentate. Head very broad and shorter than in *rufa* and *sanguinea*, eyes rather small, the antennae, and especially their scapes, shorter and much thicker. Petiole high and rather compressed anteroposteriorly, with a rounded superior border, which is scarcely or not at all excised in the middle.

Body, including the mandibles and frontal area, opaque; gaster feebly glossy.

Pilosity and pubescence grayish, the former sparse especially on the head and gaster, most conspicuous on the thoracic dorsum, the pubescence rather long and dense on the gaster.

Body, legs, and antennae black; genital appendages with yellow bases and black tips. Wings colorless.

Siberia, from the middle and southern portions of the Ural Mountains to Transbaikalia.

The nests are described as similar to those of *F. rufa* and *pratensis* and in the Ural Mountains are located on the summits and slopes of hills which are overgrown with grass and scattered birches. The pupae are said by Ruzsky not to be enclosed in cocoons.

The species is easily recognized by the peculiar coloring and robust antennae of all three phases.

42. F. ADELUNGI Forel.

F. adelungi Forel, Ann. Mus. St. Petersbourg., 1904, **8**, p. 384, ♂; Ruzsky, Formicar. Imper. Ross., 1905, p. 420, ♂; Emery, Deutsch. ent. zeitschr., 1909, p. 189, ♂.

Male. Length 7.7 mm.

(After Forel). Differs from all the known species, except *F. sanguinea* in its mandibles armed with 5–6 teeth, which are even more distinct than in the male *sanguinea*. The basal half of the mandibles is, moreover, very narrow, but the terminal half is enlarged. Clypeus carinate, with perfectly entire anterior border, thus distinguishing the species from *sanguinea*. Head very short, more than $1\frac{1}{2}$ times as broad as long, with very large eyes, occupying $\frac{2}{3}$ of its sides. Petiole with its superior border notched in the middle. In other respects like *F. sanguinea*. The same is true of the thorax. Wings shorter than in *F. sanguinea*, not surpassing the gaster and hyaline throughout, with brownish veins and stigma. Color, sculpture, and pilosity in other particulars as in *F. sanguinea* but the legs are brown, the pilosity is sparser (almost absent except on the lower surface of the gaster), and the sculpture and pubescence are a little finer.

Oasis Satsch-zou in the desert of Gobi (Roborovsky and Kozlov).

The affinities of this species, which is known from only a single male specimen, are not at all clear. Forel evidently believed it to be related to *F. sanguinea*, whereas Emery places it near *uralensis*. Its exact position cannot be determined till the worker and female have been discovered.

43. F. foreliana, sp. nov.

Worker. Length 4–6 mm.

Mandibles 8-toothed. Head, excluding the mandibles, a little longer than broad, a little narrower in front than behind, with straight posterior and feebly convex lateral borders. Clypeus strongly carinate throughout its length, with broadly rounded, projecting anterior border. Frontal carinae very slightly diverging behind, nearly parallel. Antennae long and slender, joints 2–4 of the funiculus longer and more slender than joints 8–10. Maxillary palpi very long, decidedly longer than in any of the preceding species of the *rufa* group. Thorax rather long, the pro- and mesonotum not very convex, the mesoëpinotal constriction rather shallow, the epinotum with subequal base and declivity, both straight in profile and meeting at a pronounced angle. Petiole rather narrow, cuneate in profile, with feebly convex anterior and more flattened posterior surface, blunt lateral and rather sharp, rounded, superior margin which is either entire or very feebly notched in the middle. Legs moderately long and slender.

Body including frontal area opaque, very finely shagreened; mandibles somewhat coarsely striatopunctate.

Hairs golden yellow, long, slender, erect, sparse; present only on

the mandibles, clypeus, front, vertex, pronotum, gaster, fore coxae, and in a single row on the flexor surface of the femora, tibiae, and tarsi. On the gaster the hairs, very conspicuous in certain lights, are present in three or four rows on each of the segments. Pubescence grayish, very fine, dense on the gaster, somewhat sparser on the head, thorax, scapes, and legs.

Brownish red; front, upper surface of thorax, petiole, and femora, especially the hind pair, darker or infuscated; gaster black.

Described from several specimens taken from two colonies at altitudes of 4,500 and 5,600 ft. in the Huachuca Mountains, Arizona, by Mr. C. R. Biedermann.

At first sight the species closely resembles a small *F. sanguinea rubicunda*, especially in the shape of the thorax and petiole and in pilosity, but it differs in having the anterior border of the clypeus projecting and entire, and in the much longer maxillary palpi, much more slender antennae, and the coloration of the head and thorax.

44. F. ciliata Mayr.

F. ciliata Mayr, Verh. Zool. bot. ver. Wien, 1886, **36**, p. 428, ♀; Emery, Zool. jahrb. Syst., 1893, **7**, p. 655, pl. 22, fig. 12, ♀; Wheeler, Bull. Amer. mus. nat. hist., 1903, **19**, p. 640, fig. 1, ☿ ♀ ♂.

Worker. Length 3–8 mm.

Mandibles 8-toothed. Clypeus sharply carinate its entire length, its anterior border broadly rounded, not produced. Head, excluding the mandibles, fully as broad as long, a little narrower in front than behind; occipital border slightly concave, especially in large specimens; posterior corners rounded, sides feebly convex, cheeks long. Frontal carinae distinctly diverging behind. Antennae slender, funicular joints 1–4 longer and more slender than the penultimate joints. Maxillary palpi short, pro- and mesonotum not very convex, mesoëpinotal constriction not very deep, base and declivity of epinotum subequal, forming a distinct obtuse angle with each other, the former in profile straight or feebly convex, the latter slightly concave. Petiole rather narrow, cuneate in profile, with slightly convex anterior and flattened posterior surface; border sharp, rounded on the sides, produced upwards as a blunt point in the middle.

Mandibles finely striatopunctate, feebly shining. Clypeus very finely longitudinally striated, remainder of the body delicately shagreened. Whole body opaque, except the frontal area, which is smooth and shining. The clypeus and even the whole head in the largest workers from some colonies, may be more or less shining.

Hairs golden yellow, short, and erect, those on the clypeus and mandibles rather coarse. Upper surface of head naked, gula with a few erect hairs. Eyes bare. Thorax covered with erect hairs, except the mesonotum, mesopleurae, and basal epinotal surface, which are naked. Petiole below and along its border with a fringe of short hairs, also with a few hairs on its anterior and posterior surfaces. Gaster invested with numerous uniformly distributed, short, suberect, obtuse hairs, which are not longer on the terminal than on the basal segments. Legs without oblique hairs, except the customary row on the flexor surfaces of the tibiae. Pubescence grayish, rather long and sparse on the head, thorax, and legs, on the gaster very dense and concealing the surface.

Head, thorax, and petiole of largest workers rich yellowish red, mandibles and clypeal sutures darker. Gaster brown, but appearing gray on account of the dense pubescence, anal segment and often also the venter and the base of the first segment, yellow. Antennae and legs reddish yellow, funiculus towards the tip, coxae, femora, and often also the tibiae, dark brown. The smallest workers usually have the posterior portion of the head, thoracic dorsum, and border of petiole clouded with black or dark brown. In some small specimens the whole body, excepting the mandibles and anterior portion of the head, is uniformly infuscated.

Female. Length 6–8 mm.

Thorax rather small, somewhat narrower than the head. Petiole broadly rounded, its superior border sharp, but not produced in the middorsal line as in the worker.

Mandibles subopaque, striatopunctate. Body and appendages smooth and shining, especially the head, mesonotum, and scutellum, which are very glabrous.

Pilosity extraordinary, consisting of very long, golden yellow hairs, which have a tendency to curl at their ends. These hairs are absent on the upper surface of the head, the mesonotum, and legs, excepting the coxae. They are long and conspicuous on the mandibles and clypeus, on the latter scattered over the disc and also fringing the anterior border. Gula with long, appressed hairs. Remainder of body, excepting the nude portions above mentioned, covered with long woolly hairs which form a prominent fan-like fringe on the border of the petiole. On the gaster they are long and abundant, appressed overlapping and curled at their tips, so that this region of the body appears opaque, in marked contrast to the head and mesonotum. Antennae and legs covered with minute, inconspicuous pubescence, flexor surfaces of fore femora with flexuous hairs, corresponding surfaces of middle tibiae each with a single row, hind tibiae with two rows of stiff hairs.

Color also unusual; rich reddish yellow throughout; only the terminal half of the funiculus, the mesonotum, the adjacent portion of the

scutellum, and the alar insertions black or infuscated. Wings uniformly grayish hyaline; veins and stigma more yellowish gray, the latter not very conspicuous.

Male. Length 6.5–8 mm.

Mandibles edentate, sharply pointed. Head very short, very broad behind the eyes, very narrow in front, occipital border straight. Clypeus strongly carinate. Maxillary palpi 5-jointed. Thorax robust, broader than the head. Petiole thick, convex anteriorly, more flattened posteriorly, border very blunt, evenly rounded and entire both in profile and when seen from behind.

Mandibles and upper surface of body slightly shining, remainder of body, including the frontal area, opaque.

Head, thorax, petiole, and base of gaster with short, rather dense hair; pubescence grayish, moderately developed on these and the remaining portions of the body and appendages. Eyes distinctly hairy.

Deep black even to the tips of the mandibles and appendages; genitalia yellowish, the separate sclerites tipped and bordered with black and castaneous. Wings grayish hyaline, distinctly infuscated towards their bases; veins dark brown, stigma black.

Host (Temporary). Unknown; probably *F. fusca* var. *argentea*.

Type locality.— Colorado (Mayr).

Colorado: Manitou, Ute Pass, Colorado City, Colorado Springs, Malvern, Wild Horse (7,000–8,000 ft.) (Wheeler).

Montana: Elkhorn (W. M. Mann).

The aberrant type of female, with its remarkable pilosity so much like the trichomes of many myrmecophilous beetles, suggests that this ant must be a temporary parasite on some one of the Colorado varieties of *F. fusca*, but up to the present time it has not been taken in mixed colonies. Although the female may be distinguished at a glance from the females of any of the known species of Formica, the worker and male are not so easily recognized, since they closely resemble the various western forms of *rufa* and *truncicola* and the two following species, *comata* and *criniventris*. The ground color and pilosity of the gaster of the worker are, nevertheless, peculiar, the erect hairs being very short and stubby, and more abundant than in any of the foregoing species.

45. F. comata Wheeler.

F. comata Wheeler, Journ. N. Y. ent. soc., 1909, **17**, p. 85, ☿ ♀ ♂.

Worker. Length 4.5–7 mm.

Allied to *F. ciliata* Mayr. Head, excluding the mandibles, as broad as long, broader behind than in front, with rounded posterior cor-

ners, feebly excavated posterior margin, and slightly convex sides. Eyes large. Mandibles 8-toothed. Clypeus carinate, with broadly rounded, entire anterior border, not projecting in the middle. Frontal area subsemicircular, broader than long. Antennal scapes straight at the base, slightly enlarging distally; funicular joints 1–4 somewhat more slender than the remaining joints. Palpi short. Thorax as usual in the *rufa* group of Formica, epinotum angular in profile, with subequal base and declivity, the former horizontal and slightly convex, the latter sloping and slightly concave. Petiole as high as the epinotum, in profile attenuated above, with rather sharp border; seen from behind rounded or more often produced upward in the middle in the form of a blunt point; anterior surface convex, posterior surface flat. Gaster rather large, legs of the usual configuration.

Subopaque, slightly glossy; corners of head somewhat shining; whole body finely and densely shagreened; frontal area, bases of mandibles and corners of clypeus glabrous; mandibles finely and densely striated.

Hairs yellow, short and suberect, sparse on the head, thorax, and petiole, more abundant and obtuse on the gaster, absent on the antennal scapes, present on the gula and in a single row on the flexor surfaces of the femora and tibiae, scattered on the fore coxae, long on the venter, and tip of gaster. Eyes hairless. Pubescence long, grayish, sparse on the head, thorax, and petiole, dense on the gaster, where it completely conceals the surface; somewhat conspicuous on the legs.

Yellowish red; gaster blackish brown, except a large spot at the base and the anal region, which are reddish or yellowish. Mandibles, corners of clypeus, antennae, and legs reddish brown; bases of scapes often paler; pro- and mesonotum each with a fuscous spot, pale or absent in the largest, somewhat larger and darker in the smallest workers; apical half of petiolar node more or less infuscated. Small workers also with brown or black spots on the clypeus, front, occiput, and epinotum and with the coxae more or less infuscated. Mandibular teeth black.

Female. Length 7.5–8 mm.

Resembling the female *ciliata* in form. Whole body much more shining than that of the worker as the shagreening of its surface is much more delicate; scutellum and metanotum glabrous. Pubescence like that of the worker, but longer; pilosity grayish, resembling that of the female *ciliata* but less dense, and the very long hairs on the gaster are slender, less appressed, rather straight, and not recurved at their tips. Color of the body dull brownish yellow, gaster blackish brown, except its base and anal region. Mandibles, funiculi, corners of clypeus, anterior borders of cheeks, posterior border of pronotum, a large anteromedian and two parapsidal blotches on the mesonotum, dull brown; scutellum and metanotum chestnut-brown. Wings long (9 mm.), uniformly infuscated, with brown veins and darker stigma.

Male. Length 8–8.5 mm.

Head decidedly broader than long, narrowed in the region of the cheeks, which are short and flat; posterior border of head straight, posterior corners broadly rounded. Eyes large, suboblong. Maxillary palpi 5-jointed. Mandibles 4-toothed. Clypeus convex, subcarinate, with entire, slightly reflected anterior border. Thorax and gaster of the usual shape, the former distinctly broader than the head. Petiole broad and low, with thick, rounded, transverse upper border.

Body subopaque; pleurae, scutellum, metanotum, and gaster more shining. Mandibles striatopunctate. Head and thorax very finely and densely punctate, gaster shagreened, with rather coarse, scattered piligerous punctures on its upper surface.

Hairs and pubescence grayish, more abundant than in the worker; the hairs very long on the epinotum, petiolar border, basal gastric segment and venter; somewhat shorter on the clypeus and pronotum and still shorter on the upper surface of the gaster. Eyes hairless.

Black; borders of mandibles, tibiae, tarsi, and articulations of legs brownish, or in some specimens yellowish. Genitalia sordid yellow, the tips of the appendages not infuscated.

Host. Unknown; probably *F. fusca* var. *argentea* or var. *neoclara*.

Type locality.— Colorado: Manitou (Wheeler).

Colorado: Red Rock Canyon, near Colorado City (Wheeler).

South Dakota: Harding County (S. S. Visher).

The female *F. comata*, though it superficially resembles several of the foregoing species, is nevertheless very distinct in sculpture, color, and pilosity. It is much more difficult to distinguish the worker, as it is extremely like the corresponding phase of *F. ciliata*, differing only in having a somewhat more hairy body, darker gaster and in large specimens in having the petiole narrower and with its superior border more pointed and produced upward. The worker *obscuripes* and *aggerans* have more abundant and more erect hairs on the thorax and the infuscation of workers of all sizes is much more pronounced and extensive. The male *comata* is distinguished from the male *ciliata* by its quadridentate mandibles, pale genitalia, and somewhat paler wings.

The nests of *comata* are very similar to those of *ciliata*, being under clusters of stones or about stumps and logs. These objects are rather heavily banked or even covered with vegetable detritus. The winged phases were taken July 26 and August 14.

46. F. CRINIVENTRIS Wheeler.

F. crinita Wheeler, Journ. N. Y. ent. soc., 1909, **17**, p. 87, ♀ ♀.
F. criniventris, nom. nov. Wheeler, Psyche, 1912, **19**, p. 90.

WORKER. Length 4–6.5 mm.

Resembling the worker of the preceding species but averaging somewhat smaller. Head, excluding the mandibles, a little longer than broad, even in the largest workers; narrower in front than behind with nearly straight posterior and lateral margins. Eyes rather large. Mandibles 7–8 toothed. Clypeus carinate, with entire anterior border, slightly projecting in the middle. Frontal furrow distinct. Antennae, thorax, and petiole as in *comata*. Palpi rather short. Gaster and legs of the usual shape.

Body subopaque, very finely shagreened; bases of mandibles, frontal area, and corners of clypeus glabrous. Mandibles and clypeus finely, longitudinally striated.

Hairs yellow; absent on the head, thorax, petiole, and appendages, blunt and scattered on the gaster, pointed on the clypeus, mandibles, and venter. Pubescence yellowish and very short, inconspicuous on the head, thorax, and petiole, somewhat longer on the legs and gaster; on the latter rather dense and nearly concealing the surface. Eyes hairless.

Yellowish red; gaster dark reddish brown, except the anal region and a spot at the base of the first segment, which are yellowish; tips of antennal funiculi, middle portions of femora and tibiae brownish or reddish. The smallest workers have the upper surface of the thorax, especially the pro- and mesonotum, somewhat infuscated. Mandibular teeth black.

FEMALE. Length 6.5–7 mm.

Resembling the female of *ciliata*. Body shining throughout, very finely shagreened, without pubescence. Hairs very long, yellow, curled or hooked at their tips, confined to the clypeus, gaster, and ventral surface of the petiole; on the gaster appressed and arranged in two rows near the posterior border of each segment. Body and appendages yellow; teeth of mandibles and anterior edge of clypeus black; scutellum, metanotum, and anteromedian and two parapsidal blotches on the mesonotum, anterior borders of cheeks, and a narrow band parallel with the posterior edge of each gastric segment, brown. Antennal funiculi infuscated towards their tips. Wings grayish hyaline, with pale brown veins and darker brown stigma.

HOST. Unknown, probably *F. fusca* var. *argentea* or *neoclara*.

TYPE LOCALITY.— Colorado: Boulder, (Wheeler).

Montana: Helena (Hubbard and Schwarz).

South Dakota: Harding County (S. S. Visher).

The worker differs from those of *ciliata*, *comata*, and *oreas* in the absence of hairs on the head, thorax, and petiole, and the female has much fewer hairs and these are confined to the clypeus and gaster. The hairs are very easily rubbed off in both workers and females, but the long series of the former and the callows of the latter show that they cannot be more abundant than described above. The colony from which the type specimens were taken was very populous. Its nest resembled very closely those of *ciliata*, *comata*, and *oreas* which I have examined in Colorado. It was under several contiguous stones, banked with vegetable detritus and in the immediate neighborhood of flourishing colonies of *F. ciliata* and *rufa aggerans*.

47. F. OREAS Wheeler.

F. oreas Wheeler, Bull. Amer. mus. nat. hist., 1903, **19**, p. 643, ☿ ♀ ♂.

WORKER. Length 4.5–7 mm.

Resembling the workers of *F. ciliata*, *comata*, and *criniventris*. Mandibles 8-toothed. Head, excluding the mandibles, as broad as long, slightly narrower in front than behind, with feebly concave posterior border, rather broadly rounded posterior corners, and convex sides. Clypeus carinate its entire length, with broadly rounded, not produced anterior border. Antennae rather slender, funicular joints 1–3 longer and more slender than the penultimate joints. Frontal carinae rather strongly diverging. Palpi short. Thorax with convex pro- and mesonotum and deep mesoëpinotal constriction. Epinotum with the base horizontal and slightly convex, distinctly longer than the rapidly sloping and distinctly concave declivity with which it forms an obtuse angle. Petiole broad, compressed anteroposteriorly with a sharp superior border, which is either bluntly pointed or slightly truncated in the middle.

Body subopaque, very finely shagreened, anterior portion of head smooth and shining, mandibles and clypeus longitudinally striated, shining; frontal area glabrous.

Hairs silvery white or pale yellow, short, abundant, erect, covering both the dorsal and gular surfaces of the head, the thorax, border of petiole, and gaster. Hairs on the ocellar region conspicuously long. Scapes and legs covered with shorter, suberect hairs. Hairs on the gaster pointed and more delicate than in the three preceding species, long on the venter and terminal segments. Eyes hairy. Pubescence yellowish, sparse on the head, somewhat more abundant on the thorax and sufficiently dense on the gaster to conceal the surface and give it a grayish tinge.

Bright yellowish red, mandibles and antennal scapes darker; funiculi and legs reddish brown, their articulations more yellowish. Gaster black, anal segment, a large spot at the base of the first segment and often a spot on each of the sternites, yellow or red. Some of the smallest workers have the vertex, pro- and mesonotum blotched with black, but others have the head and thorax almost as immaculate as large individuals.

Female. Length 7.5–9 mm.

Head resembling that of the worker but with less convex sides. Carina of clypeus delicate. Thorax nearly as broad as the head, robust. Petiole very broad, much compressed anteroposteriorly, feebly convex in front, flattened behind, the sharp border broadly rounded, more rarely bluntly angular in the middle.

Mandibles striatopunctate, somewhat less shining than the remainder of the body, which, together with the appendages, is smooth; the upper surface of the head, mesonotum, and scutellum, especially are highly glabrous.

Entire body, including the antennal scapes and legs, covered with short, delicate, erect or suberect, silvery white hairs which nowhere conceal the shining surface. These hairs are abundant and conspicuous on the scapes, legs, and gaster, less abundant on the front of the head, and on the mesonotum, at least in some specimens. Eyes hairy.

Color rich yellowish red; mandibular teeth, anterolateral borders of clypeus, thoracic sutures, alar insertions, metanotum, and adjacent border of scutellum, posterior border of each gastric segment, palpi, articulations of legs, and terminal half of funiculi, black or infuscated. Wings uniformly gray, veins and stigma sordid yellow.

Male. Length 7–8 mm.

Mandibles 3–4-toothed. Maxillary palpi slender, 5-jointed. Head small, eyes large, cheeks rather concave, postocular region less prominent than in the male *ciliata*. Clypeus sharply carinate. Thorax robust, decidedly broader than the head. Petiole low, cuneate in profile, thick at base, but becoming rapidly thin towards the superior border, which when seen from behind is feebly and broadly excised in the middle.

Body opaque, finely shagreened; frontal area shining; mesonotum, scutellum, and gaster above slightly lustrous.

Hairs gray, dense, longest and suberect on the head, thorax, and petiole, more reclinate on the gaster, very short and subappressed on the legs and antennae. Eyes distinctly hairy. Gaster delicately gray pubescent.

Deep black; genitalia, tips of trochanters, knees, basal portions of first and second tarsal joints, reddish yellow. Wings like those of the female, except that the stigma is darker.

Host. Unknown; probably one of the subalpine varieties of *F. fusca.*

Type locality.— Colorado: Woodland Park, Ute Pass, 8,500 ft. (Wheeler).

Colorado: Buena Vista, Boulder, Wild Horse, Salida, Florissant (Wheeler).

New Mexico: Embudo (T. D. A. Cockerell).

The female of this species is readily distinguished from the female of *creniventris* and *ciliata* by its pilosity and from the females of all the other species described above by its color and the erect hairs on the antennal scapes. This last character also enables one to separate the worker from the very similar workers of all the foregoing species of the *rufa* group.

There can be little doubt that this ant is a temporary parasite on some form of *F. fusca.* The nests which I saw in the localities recorded above during the summer of 1903 and 1906 were not abundant but were very populous. They were established in open, sunny places, under stones, the edges of which were heavily banked with vegetable detritus.

48. F. oreas Wheeler var. comptula, var. nov.

Worker. Length 3–7 mm.

Differing from the worker of the typical *oreas* in color and pilosity. The red portions of the body are darker and less yellowish, the gaster blacker, the legs dark brown, or nearly black, with red articulations. In small workers the vertex, upper surface of thorax and petiole are rather heavily infuscated. The erect hairs on all parts of the body, especially on the head, are somewhat more abundant; the hairs on the gaster though very numerous are only half as long as in *oreas*, and as the pubescence is shorter and sparser on this region, it appears blacker and less glaucous.

Female (deälated). 7.5–8 mm.

Differing from the female of the typical *oreas* in having the white hairs covering the body, scapes, and legs conspicuously more abundant and somewhat coarser. On the legs and scapes the hairs are more erect, and they are very dense on the epinotum, petiole, and upper surface of the gaster.

Described from two females and ten workers taken by Mr. Wm. M. Mann from a large colony at Pullman, Washington. Mr. Mann has also taken workers and females of this variety at Elkhorn, Montana.

49. F. ferocula, sp. nov.

Worker. Length 3.5–6 mm.

Head, excluding the mandibles, as broad as long, broader behind than in front, with feebly excised posterior border and very slightly convex sides. Mandibles 8-toothed. Clypeus convex, carinate its entire length, with broadly rounded anterior border, but slightly or not at all produced in the middle. Frontal area triangular, as long as broad. Frontal carinae short, diverging. Antennae slender, four basal funicular joints longer and more slender than the penultimate joints. Palpi short. Pro- and mesonotum not very convex, meso-ëpinotal constriction not very deep, epinotum with subequal base and declivity, the former feebly convex, the latter distinctly concave. Petiole narrow and very low, its anterior surface very convex, its posterior surface flattened, its border very blunt and when seen from behind, evenly rounded and entire, not produced upward in the middle. Legs rather long.

Opaque, finely shagreened; mandibles shining, rather superficially striatopunctate; frontal area smooth and shining, clypeus also more shining than the posterior part of the head.

Hairs and pubescence golden yellow; the former abundant on the clypeus and mandibles, absent on the remaining portions of the head; dense and erect on the pronotum, epinotum, and petiole, absent on the mesonotum, except at the posterior border. On the gaster the erect hairs are short, obtuse, and rather abundant. Eyes hairless. Pubescence long and rather dense on the head and thorax, scarcely denser on the gaster and not concealing the ground color. Pubescence on the legs long and somewhat oblique on the flexor surfaces of the tibiae.

Bright yellowish red; mandibles, antennal funiculi towards their tips, and the legs in some specimens, darker. Gaster dark brown, with the anal region and a spot at the base of the first segment red. Very small workers have the upper surface of the head, thorax, and petiole infuscated and the legs darker.

Described from sixteen workers taken from a single colony at Rockford, Illinois. This and several other colonies of the same species were found nesting in dry, open fields in crater nests 3–4 inches in diameter about the roots of *Erigeron canadense* and other weeds. The species is evidently allied to *F. comata*, *criniventris*, *ciliata*, and *oreas*, but differs from all of these forms in the peculiar shape of the petiole and the arrangement of the hairs. The female is probably of a peculiar aberrant type, like the females of the forms just mentioned.

50. F. DAKOTENSIS Emery.

F. dakotensis Emery, Zool. jahrb. Syst., 1893, **7**, p. 652, taf. 22, fig. 5, ☿.
F. subpolita var. ? *specularis* Emery, Zool. jahrb. Syst., 1893, **7**, p. 663, ♀ (*in part*).

WORKER. Length 5–6 mm.

Mandibles 8-toothed. Head, excluding the mandibles, as broad as long, a little broader behind than in front, with feebly excised posterior margin, broadly rounded posterior corners, and convex sides. Clypeus convex, sharply carinate, its anterior border not produced, broadly rounded. Frontal area triangular, as long as broad; frontal carinae strongly diverging. Antennal scapes slender at the base, distinctly enlarged at their tips; funicular joints 2–4 a little more slender and not much longer than the penultimate joints. Palpi very short. Thorax shaped much like that of *F. sanguinea*, with moderately convex pro- and mesonotum, moderately deep mesoëpinotal constriction and the epinotum rather angular, with subequal base and declivity, the former straight and horizontal in profile, the latter slightly concave. Petiole narrow, in profile cuneate, thick below, with rather strongly convex anterior, more feebly convex posterior surface, and blunt superior margin. Seen from behind it is narrow below, but gradually broadening dorsally, with straight sides and horizontal or feebly and broadly excised superior border, so that it appears truncated above.

Subopaque, very delicately shagreened; mandibles and clypeus more shining, the former finely striatopunctate; clypeus very finely longitudinally striated. Frontal area smooth and shining. Gaster more distinctly shagreened than the body, shining with the same luster as in *F. truncicola obscuriventris* and *F. exsectoides*.

Upper surface of head, thorax, and petiole without hairs or with a very few scattered yellow hairs. Those on the gaster longer, blunt and scattered, apparently deciduous on the upper surface, longer and more abundant on the venter. Gula and eyes hairless. Pubescence very fine and sparse, scarcely perceptible on the body, more distinct on the legs and scapes.

Light or dark red, funiculi darker, gaster black or very dark brown, the base of the first segment not distinctly reddish.

FEMALE (After Emery). Length 7.5–8 mm.

Antennae, metanotum, tibiae, tarsi, and whole of gaster brown, first gastric segment ferruginous red at the base. The whole insect very shining; mesonotum and gaster as smooth as a mirror, the latter with only a few small punctures which bear the very sparse, short pubescence; erect hairs rather numerous on the base, tip, and venter of the gaster, sparse and very short on the head, thorax, and petiole; lower

surface of head without hairs. Pubescence on head and thorax dilute and very short, completely lacking on the mesonotum. Head broad behind and with a straight margin and rounded posterior corners. Clypeus broadly rounded, scarcely carinate, shining, feebly and obliquely striated. Mandibles shining, strongly sculptured; petiole cuneate, squarely truncated above.

Host (Temporary). Probably *F. fusca* var. *subsericea*.

Type locality.— South Dakota: Hill City (Th. Pergande).

British Columbia: Golden (W. Wenman).

Nova Scotia: Digby (J. Russell).

I have redescribed the worker of this species from a cotype. It is easily recognized by the shape of the head and especially by the petiole, which differs from that of all other species of Formica known to me. The palpi, too, as Emery has observed, are remarkably short. The specimens from the three localities mentioned above all agree in having extremely few or no hairs on the dorsal surface of the body and none on the gula, thus coinciding with Emery's remark "superne haud pilosa," so that the following form, which I first described as a distinct species and later regarded as identical with the typical *dakotensis*, may be retained as a variety.

51. F. dakotensis var. montigena Wheeler.

F. montigena Wheeler, Bull. Amer. mus. nat. hist., 1904, **20**, p. 374, ☿ ♀ ♂.

Worker. Length 3.5–6.5 mm.

Differing from the worker of the typical *dakotensis* in having longer and more numerous erect hairs on the upper surface of the head, thorax, and petiole, and in having a few erect hairs on the gula. The pubescence on the gaster and legs seems also to be a little longer and more distinct. The gaster is more brownish or reddish and the base of the first segment is often yellow or red.

Female. Length 7 mm.

Mandibles and clypeus like those of the worker. Head large, as broad as long, its sides straight, slightly converging in front, its posterior angles rounded, its posterior border feebly excised. Thorax distinctly narrower than the head. Petiole extremely thick and blunt, its upper border transverse and feebly excised when seen from behind. Wings as long as the body (7 mm.).

Body and legs very glabrous and shining. Mandibles coarsely striatopunctate. Clypeus delicately striated anteriorly. Antennae subopaque.

Hairs suberect, sparse, yellowish, longest on the gaster, especially

towards its tip, shorter on the head and thorax and confined to the flexor surfaces of the femora and tibiae. Pubescence grayish, very dilute and inconspicuous, except on the antennae.

Rich yellowish red. Mandibles, corners of clypeus, tarsi, and antennal scapes darker. Mandibular teeth black; funiculi, gaster, scutellum, metanotum, a triangular anterior, and two elongate parapsidal blotches on the mesonotum dark brown. Wings grayish hyaline, not infuscated, with pale brown veins and darker stigma.

Male. Length 6.5–7 mm.

Mandibles 3–4 toothed. Head very short and broad, narrow in front, posterior corners prominent and rounded; eyes large; cheeks short, concave. Clypeus convex, carinate. Thorax broad and robust. Petiole low, thick, transverse, with very blunt border, which, seen from behind, is broadly and distinctly excised.

Body subopaque; mandibles and frontal area slightly, upper surface of gaster more distinctly shining.

Hairs and pubescence sordid yellow, sparse, and inconspicuous, especially on the upper surface of the gaster.

Black. Genitalia reddish yellow. Legs sordid yellow; femora, especially the fore pair, more or less infuscated. Wings whitish hyaline, with pale brown veins and slightly darker stigma.

Hosts (Temporary). *F. fusca* var. *subsericea*, and *F. pallidefulva schaufussi* var. *incerta*.

Type locality.— Colorado: Ute Pass and Pike's Peak, 10,000–11,500 ft. (Cockerell and Wheeler).

Colorado: North Cheyenne Canyon, near Colorado Springs, Florissant, Buena Vista (Wheeler).

New Mexico: Beulah, 8,000 ft. (T. D. A. Cockerell).

Montana: Helena (W. M. Mann).

Idaho: Troy (W. M. Mann).

That this variety is a typical temporary parasite is shown by the fact that I found two small mixed colonies (with *F. incerta*) on Pike's Peak and that Mr. Mann found a single colony mixed with *F. subsericea* at Troy, Idaho. The adult colonies are large, and form nests under stones or about the roots of plants which are banked with considerable vegetable detritus.

52. F. dakotensis var. specularis Emery.

F. subpolita var. ? *specularis* Emery, Zool. jahrb. Syst., 1893, **7**, p. 663, ♀ (*in part*).

F. dakotensis Wasmann, Allgem. zeitschr. ent., 1901, **6**, p. 6.

F. dakotensis Emery var. *wasmanni* Forel, Ann. Soc. ent. Belg. 1904, **48**, p. 153, *nota* ☿ ♀ ♂.

Worker. Length 5–7 mm.

Differing from the typical *dakotensis* in having the sides of the head a little less convex, the anterior border of head a little narrower, and the gaster somewhat paler. The pubescence is longer and more distinct on head and thorax. The pilosity is that of the type and not that of the var. *montigena*.

Female. Length 7–8 mm.

Differing from the females of the typical *dakotensis* and the var. *montigena* in color, being yellowish red except the posterior borders of the gastric segments, the antennae, and tibiae which are brown, and the mandibles which are deep red. Wings with a yellowish tinge, veins light brown, stigma darker.

Male. Length 7.5–8 mm.

Closely resembling the male of the var. *montigena*, but the legs and genitalia of a purer yellow and the gaster dark brown instead of black. This is the case in ten specimens in my collection and can hardly be due to immaturity. Wings colored as in the female.

Host (Temporary). *F. fusca* var. *subsericea*.

Type locality.— Wisconsin (Wasmann).

Wisconsin: Prairie du Chien (H. Muckermann).

Emery described two different females under the name *specularis*, the first belonging to this variety, the second to the typical *dakotensis*. Muckermann found several colonies of *specularis* mixed with *subsericea* and Wasmann concluded from this that the former ant was an incipient slave-maker. It is evident that this conclusion is erroneous, since my observations on the var. *montigena*, show that the species is a temporary social parasite, like many, if not all, other forms of the *rufa* group.

Microgyna Group.

53. F. microgyna microgyna Wheeler.

F. microgyna Wheeler, Bull. Amer. mus. nat. hist., 1903, **19**, p. 645, fig. 3, ☿ ♀ ♂, p. 656, fig. 1 (gynandromorph).

Worker. Length 3.5–6 mm.

Mandibles 8-toothed. Clypeus rounded in front, not produced, carinate its entire length and with uneven surface. Maxillary palpi rather long. Head, excluding the mandibles, somewhat longer than broad even in the largest workers, but little narrower in front than behind, with straight posterior border and straight subparallel sides.

Antennae rather slender, scapes but slightly enlarged toward their tips, joints 2–4 of the funiculus decidedly longer and more slender than the penultimate joints. Frontal area semicircular, broader than long, frontal carinae distinctly diverging behind. Pro- and mesonotum convex, mesoëpinotal constriction narrow and rather deep, epinotum rounded, its base convex. Petiole narrow, its anterior surface convex, its posterior surface more flattened, with entire, blunt border, projecting upward in the middle in some specimens, in others evenly rounded or even slightly excised.

Body opaque, finely shagreened. Mandibles opaque and finely striated apically, smooth and shining at the base. Clypeus opaque, very finely striated. Frontal area smooth and shining.

Entire insect, including appendages, covered with microscopic gray pubescence, dense and most distinct on the gaster. Hairs pale yellow, erect, and, except on the mandibles, distinctly clavate, with obtuse tips. These hairs are sparse on the clypeus, on the front, where they form four longitudinal rows as far back as the ocelli, on the thoracic dorsum, coxae, border of the petiole, and surface of the gaster. On the last they are particularly conspicuous on account of their equidistant arrangement and contrasting color. They are easily rubbed off. A few hairs are occasionally present on the gula but usually entirely absent. Anterior border of scape with a row of delicate, suberect, tapering hairs. Tibiae covered with very short, stiff, suberect hairs. Eyes hairless.

Head, thorax, and petiole deep yellowish red, mandibles and clypeus somewhat darker, ocellar region often fuscous. In small workers the front, vertex, thoracic dorsum, and petiole are spotted with black. Gaster black, with only the anal region yellowish. In the largest workers the legs are red throughout, in intermediates the femora and tibiae are brownish, in the smallest workers the infuscation extends also to the coxae. Antennae red, funiculi more or less infuscated toward the tip.

Female. Length 4–4.5 mm.

Head resembling that of the worker. Thorax distinctly narrower than the head. Petiole narrow, thick at the base, both its anterior and posterior surfaces alike convex, its dorsal border sharper than in the worker; seen from behind variable, in some specimens evenly rounded, in others somewhat produced upward in the middle.

Sculpture like that of the worker. Whole insect, including the antennae and legs, clothed with delicate white hairs, which are longer and more abundant than in the worker and not clavate though obtuse. These hairs are conspicuously long and suberect on the front, gula, thorax, petiolar border, gaster, antennal scapes, and legs. In addition to these hairs the body and appendages are invested with microscopic, white pubescence.

Head, thorax, petiole, and legs dull, reddish or brownish yellow. Mandibular teeth, funiculi, a blotch covering the ocellar region, a large anteromedian mesonotal, and two elongate parapsidal blotches, alar insertions, metanotum, and more or less of the contiguous portion of the scutellum, fuscous. In some specimens the clypeus, frontal region, coxae, and pleurae are infuscated. Gaster dark brown, anal segment, and more or less of the base of the first gastric segment, brownish yellow. Wings whitish hyaline, veins and stigma brown, the latter conspicuous.

Male. Length 5–5.5 mm.

Mandibles slender, edentulous or indistinctly 3-toothed, pointed. Maxillary palpi 5-jointed. Head rather short, broad, and convex behind the eyes, narrow in the region of the cheeks. Eyes large. Clypeus distinctly carinate anteriorly. Antennae slender. Thorax broader than the head, rather robust, mesonotum flattened in front of the scutellum. Petiole very thick, with obtuse and broadly rounded border. Genitalia rather slender.

Subopaque; frontal area, anteromedian suture of mesonotum, parapsidal furrows, paraptera, and upper surface of gaster smooth and shining. Mandibles coarsely punctate near the tips, finely striated toward the base. Frontal area slightly shining.

Body and appendages clothed with microscopic grayish pubescence, which is sparse and visible only in certain lights. Hairs covering the body and appendages delicate, sparse, suberect, of an indistinct grayish color. Eyes naked.

Deep black: legs and genitalia dirty yellow; coxae, femora, tibiae, and terminal tarsal joints more or less infuscated. Wings like those of the female.

Hosts (Temporary). *F. fusca* var. *argentea* and *F. neogagates*.

Type locality.— Colorado: Manitou (Wheeler).

Colorado: Florissant (Wheeler).

The colonies of this and the following species, here included in the *microgyna* group, are much smaller than those of the *rufa* group, but the nests are much like those of *truncicola* and the allied forms, being under single stones or clusters of stones, which are banked with more or less vegetable detritus.

54. F. microgyna microgyna var. recidiva, var. nov.

Worker. Length 3.5–6 mm.

Differing from the worker of the typical form in lacking the erect hairs on the antennal scapes and in having the hairs on the tibiae shorter, more abundant, and somewhat more appressed.

Male. Indistinguishable from the male of the typical *microgyna*. Mandibles indistinctly toothed in two specimens.

Described from two males and numerous workers taken from three colonies at Florissant, Colo. Four workers taken by Prof. T. D. A. Cockerell at Pecos, New Mexico are also referable to this variety. One occasionally finds workers which are intermediate between this variety and the type in possessing a few erect hairs on the anterior surface of the antennal scapes near the base. The nests are in all respects like those of the typical form.

55. F. MICROGYNA RASILIS Wheeler.

F. microgyna var. *rasilis* Wheeler, Bull. Amer. mus. nat. hist., 1903, **19**, p. 648, ☿ ♀ ♂.

WORKER. Length 4–6.5 mm.

Closely related to the typical *microgyna* but averaging a little larger. Head slightly longer than broad, very nearly as broad in front as behind, with feebly concave posterior border in the largest individuals and nearly straight sides. Clypeus convex, carinate its entire length, its anterior border somewhat angularly projecting in the middle. Frontal area triangular, as long as broad. Frontal carinae diverging. Antennae rather slender, the basal joints much longer and more slender than the penultimate joints. Maxillary palpi rather long. Thorax shaped as in *microgyna*, the petiole with a somewhat sharper border.

Sculpture as in *microgyna*. Mandibles and frontal area but slightly shining. Legs rather smooth.

Hairs golden yellow, obtuse, sparser than in *microgyna*, and stouter, absent on the antennal scapes, gula, and posterior corners of the head, and the eyes and legs, except for the row of bristles on the flexor surfaces of the tibiae, entirely naked. Hairs on the clypeus, thorax, and petiole much less numerous. Pubescence very fine and uniform, not very dense on any part of the body. Color like that of *microgyna*.

FEMALE. Length 5–5.5 mm.

Averaging a little larger than the female of *microgyna* and differing in pilosity, sculpture, and color. The gaster is more opaque, the black blotches on the head and thorax are indistinct or entirely lacking, even in mature specimens. The wings are more grayish and the hairs on the head, thorax, petiole, and gaster are sparser, stouter, more clavate and more obtuse. The antennal scapes and legs are without erect hairs.

MALE. Length 6–7 mm.

Mandibles edentate or quadridentate, their blades broader than in *microgyna*. Frontal area smooth and shining. Erect hairs on gula less abundant as are also the oblique hairs on the legs. Wings somewhat more opaque.

Host (Temporary). *F. fusca* var. *argentea* and var. *subsericea*.

Type locality.— Colorado: Manitou (Wheeler).

Colorado: Ute Pass, Pike's Peak (11,500 ft.), Colorado Springs, Florissant, Wild Horse (Wheeler).

New Mexico: Pecos (T. D. A. Cockerell).

Utah: Salt Lake (R. V. Chamberlin).

Washington: Olympia (T. Kincaid).

This form was originally described as a variety of *microgyna* but after examining more material than I possessed at the time of its description, I am convinced that it should have subspecific rank, at least. It has apparently the same range as the typical *microgyna*, but is more abundant and forms more populous colonies. These live under stones and may occupy several nests covering an area of a square meter or more. Between July 11 and August 21, 1903, I found, in all, thirteen of these colonies in the neighborhood of Manitou, Colo. and during July 1906 I found nearly as many more at Florissant, and Wild Horse in the same state. A few of these colonies were very small and young and mixed with workers of *F. fusca* var. *argentea* and var. *subsericea*, proving that *rasilis* is a temporary social parasite on these ants.

56. F. microgyna rasilis var. spicata, subsp. nov.

Worker. Length 3.5–6 mm.

Closely resembling the worker of *rasilis* but even the largest individuals have the pro- and mesonotum and nearly always also the ocellar region infuscated or blackened, and the hairs on the gaster are longer and slightly more numerous. The pubescence on the gaster is denser so that this region is gray and its ground color is concealed. Legs and antennal scapes without erect hairs. Gula in some specimens pilose. Frontal area very smooth and shining.

Female. Length 4.5–5 mm.

Differing from the female *rasilis* in having the blunt clavate hairs on the head, thorax, and gaster longer and more numerous. This is especially true of those on the gaster. Gaster opaque, owing to the dense and rather long pubescence. Body and legs brownish yellow, with the upper surface of the head, mesonotum, scutellum, meso- and metapleurae, gaster, antennal funiculi, and usually also the coxae dark brown. Wings grayish hyaline.

Male. Length 5.5–6 mm.

Mandibles broad, usually edentate, more rarely obscurely dentate. Petiole very low, scarcely higher than long, its upper surface in profile

obliquely flattened above so that the posterior surface is higher than the anterior. Seen from behind the upper border is entire and broadly rounded. In *rasilis* and the typical *microgyna* the border is sharper and more compressed. Frontal area very smooth and shining. Color, sculpture, and pilosity as in these forms. Upper surface of head and thorax, and the gula with rather numerous erect hairs; tibiae with numerous oblique hairs. Wings as in the female.

Described from numerous workers, males, and rather immature females taken from five colonies at Florissant, Colorado (altitude 8,100 ft.).

57. F. MICROGYNA SCITULA, subsp. nov.

FEMALE. Length 4.5 mm.

Closely resembling the female of *rasilis* in color, except that the base of the first gastric segment is brownish red like the head; thorax, petiole, legs, scapes and base of the funiculi, and the wings are faintly but distinctly infuscated. Anal region reddish. Gaster and terminal funicular joints dark brown. The clavate hairs on the head, thorax, and gaster are as long as in the var. *spicata* but more numerous on the posterior portion of the pronotum and the whole of the mesonotum. Gula with a very few erect hairs. Pubescence very fine and indistinct, except on the gaster. There are no oblique or suberect hairs on the scapes or legs. The body, including the legs and gaster, is smooth and slightly shining, the frontal area subopaque.

Described from a single specimen taken during June 1909 by Mr. W. T. Davis at Clayton, Georgia, 2,000–3,700 ft.

This specimen is so much like the female *microgyna*, and especially those of its subspecies *rasilis* and the var. *spicata* that I feel compelled to place it here, although the locality is far distant from the range of the allied forms. Its ultimate taxonomic position will, of course, depend on the discovery of the worker and male.

58. F. NEVADENSIS Wheeler.

F. microgyna var. *nevadensis* Wheeler, Bull. Amer. mus. nat. hist., 1904, **20**, p. 373, ♀.

F. nevadensis Wheeler, Bull. Amer. mus. nat. hist., 1905, **21**, p. 272; Ants, 1910, p. 570.

FEMALE. Length 4.5 mm.

Closely resembling the female of the typical *F. microgyna* but differing in the following characters:— The petiole in profile is cuneate,

FIG. 4.— Distribution of the forms of the *Formica microgyna* group.

thick below, with very sharp upper border and straight anterior and posterior surfaces. The erect, silvery white hairs covering the body, legs, and antennal scapes are longer and more abundant. The pubescence is very fine and sparse on the gaster so that this region is very smooth and shining. The mesonotum is not spotted but, together with the scutellum, paraptera, and metanotum, uniformly dark brown and rather sharply marked off from the remaining paler portions of the thorax, which are brownish red. Occiput slightly infuscated. Gaster very dark brown, anal region red. Wings grayish hyaline, with brown veins and stigma.

Nevada: Ormsby County, July 1903 (C. F. Baker).

Although this form is readily distinguished from the females of all the forms of *microgyna* by its very smooth gaster, more material may show that it is to be regarded as a subspecies of *microgyna* and not as an independent species.

59. F. IMPEXA Wheeler.

F. impexa Wheeler, Bull. Amer. mus. nat. hist., 1905, **21**, p. 273, ☿ ; Psyche, 1906, **13**, p. 40, ♀ ; Ants, 1910, p. 570.

WORKER. Length 3.3–6 mm.

Resembling *F. microgyna*. Mandibles 8-toothed. Clypeus broadly rounded in front, not produced in the middle, carinate its entire length. Head, excluding the mandibles, distinctly longer than broad even in the largest workers, with straight posterior and straight, subparallel lateral borders. Joints 1–4 of funiculi decidedly longer and more slender than the penultimate joints. Maxillary palpi rather short. Thorax with the epinotum low and much rounded, without distinct base and declivity, mesoëpinotal constriction rather narrow and shallow, pro- and mesonotum moderately convex. Petiole narrow, cuneate in profile, its anterior surface convex, its posterior surface flat, its border moderately sharp and produced upward in the middle. In small workers the edge may be much more blunt.

Mandibles lustrous, finely and sharply striated. Surface of clypeus uneven. Frontal area smooth and shining. Remainder of body opaque, finely but distinctly shagreened.

Whole body and appendages clothed with very minute white pubescence, which is rather sparse on the head and thorax, but dense and concealing the ground surface of the gaster. Body, antennal scapes and legs covered with short, coarse, obtuse, erect or suberect, whitish or yellowish hairs. On the gaster these are uniformly distributed and in certain lights very conspicuous, but shorter than in the various forms of *microgyna*. They are also very numerous and prominent

on the thoracic dorsum, clypeus, front, vertex, posterior corners and gular surface of head, but absent or very sparse on the cheeks, pleurae, and coxae. They are prominent both on the flexor and extensor surfaces of the legs.

Head and thorax red. Gaster black. Even in the largest specimens the mandibles, anterior border of clypeus and apical half of funiculi are dark reddish brown; ocellar triangle, upper surface of pro- and mesonotum, much of the upper surface of the petiole, legs and coxae, except their articulations, more or less blackened or infuscated. Fore coxae largely red. Anal region yellowish. In the smallest workers the infuscation is more extensive, involving the whole of the posterior portion of the head and epinotum.

Female. Length 4.5 mm.

Resembling the worker in sculpture and pilosity. Head, thorax, petiole, and legs yellowish or reddish brown. Tips of funiculi, scutellum, metanotum, and gaster dark brown; mesonotum with three elongate brown blotches. Wings gray, with brown veins and stigma.

Host (Temporary). *F. fusca* var. *subaenescens.*

Type locality.— Michigan: Porcupine Mts. (O. McCreary).

Massachusetts: East Holliston, Sherborn (A. P. Morse).

This species, too, is very closely related to the typical *F. microgyna*, but both the worker and female are much more densely and coarsely pilose and the epinotum of the worker is peculiarly low and rounded. The colony of this species found by Mr. Morse at Sherborn, Mass. was apparently still mixed with workers of *F. fusca* var. *subaenescens*, although it contained a few winged females of the parasitic species.

60. F. adamsi Wheeler.

F. adamsi Wheeler, Journ. N. Y. ent. soc., 1909, **17**, p. 84, ♀ ; Rept. Mich. geol. survey for 1908, 1909, p. 326 ♀ ; Ants, 1910, p. 570.

Worker. Length 3.5–5 mm. Allied to *F. microgyna*. Head, excluding the mandibles, a little longer than broad, very nearly as broad in front as behind, with straight sides and straight or slightly concave posterior border. Eyes rather large. Mandibles 7–8 toothed. Clypeus strongly carinate, with broadly rounded anterior border, not produced in the middle. Palpi of moderate length. Antennae slender, scapes nearly straight at the base, funicular joints all distinctly longer than broad, the basal somewhat more slender and longer than the apical joints. Pro- and mesonotum moderately convex, mesoëpinotal constriction rather shallow, broad at the bottom, epinotum with subequal base and declivity, the former slightly convex, the

latter flattened or slightly concave; the two surfaces passing into each other through a distinct but rounded angle. Petiole narrow, in profile compressed anteroposteriorly, with convex anterior and flattened posterior surface and sharp superior border, which when seen from behind is rounded and usually but slightly produced upward in the middle.

Opaque throughout, except the bases of the mandibles, the frontal area, and sides of the clypeus, which are shining. Mandibles finely and densely striated. Surface of body densely and indistinctly shagreened.

Hairs and pubescence pale yellow; the latter covering the whole body and appendages, not conspicuous except on the gaster, but even on this region not sufficiently dense to conceal the surface sculpture. Hairs short, sparse and obtuse, in several rows on the gastric segments; on the thorax confined to the upper portions of the pro- and mesonotum, on the head to the clypeus, front, and vertex. The hairs on the mandibles are appressed and pointed, on the palpi short but numerous and conspicuous. Legs and antennae naked, the former only with a series of pointed bristles on the flexor surfaces of the tibiae and tarsi and a few blunt hairs on the anterior surfaces of the fore coxae.

Sordid brownish red, the smaller specimens somewhat more yellowish red. Gaster dark brown, except a large spot at the base of the first segment and the anal region, which are reddish yellow. A large spot on the pronotum, one on the mesonotum, much of the posterodorsal portion of the head, the distal halves of the antennal funiculi and in many specimens also the coxae and femora, dark brown or blackish. These dark markings are present in the largest as well as in the smallest workers.

Host (Temporary). Probably *F. fusca*.

Type locality.— Michigan: Isle Royale (H. A. Gleason).

In coloration, this ant resembles very closely small specimens of the European *F. rufa pratensis*, and can be distinguished from all the preceding forms of the *microgyna* group by the extensive infuscation of the upper surface of the head. Mr. Gleason describes the nests on Isle Royale as "one of the most conspicuous features of the drier tamarack swamps. They are rounded-conical in shape, 3–6 dcm. high or even larger, with a diameter at the base about equalling the height. They are composed within of Sphagnum, but as would be expected with such material, without any definite system of galleries. The outer surface is thickly covered with leaves of Cassandra, probably to prevent loss of moisture by evaporation from the interior. They are frequently placed near or under a bush of the Cassandra, but the same covering is used if no Cassandra is near."

61. F. ADAMSI var. ALPINA Wheeler.

F. adamsi var. *alpina* Wheeler, Journ. N. Y. ent. soc., 1909, **17**, p. 84, ☿ ; Rept. Mich. geol. survey for 1908, 1909, p. 327, ☿ .

WORKER. Length 3.5–5 mm.

Differing from the typical *adamsi* in having the border of the petiole more attenuated and more produced upward in the middle, in the black markings on the head, pro- and mesonotum being more restricted and in having the frontal area smoother and more shining.

TYPE LOCALITY.— Colorado: Pikes Peak, 10,500–11,000 ft., (Wheeler).

Idaho: Troy (W. M. Mann).

Nova Scotia: Boisdale, Cape Breton I. (Amer. Mus. Nat. Hist. Coll.).

The red portions of the specimens from Idaho are paler than in those from Colorado and Cape Breton I. and the yellow spot at the base of the gaster is conspicuous. The true status of this variety, however, can be determined only by the study of more material than I have been able to secure.

62. F. NEPTICULA Wheeler.

F. nepticula Wheeler, Bull. Amer. mus. nat. hist., 1905, **21**, p. 270, ☿ ♀ ♂; Ibid., 1906, **22**, p. 64.

WORKER. Length 3.5–6 mm.

Mandibles 8-toothed. Head, excluding the mandibles, a little longer than broad, but little narrower in front than behind, with straight sides and posterior border. Clypeus strongly carinate, its anterior border angularly produced in the middle. Frontal area triangular, as long as broad. Antennae rather stout, first to fourth funicular joints longer and more slender than the penultimate joints. Thorax in profile with very convex pro- and mesonotum and very deep mesoëpinotal constriction, which is broad at the bottom. Epinotum rounded, without distinct base and declivity, or, at any rate, without an angle between the base and declivity. Petiole large, as high as the epinotum, convex in front, more flattened behind, border rather sharp; seen from behind it is transverse in the middle and obliquely truncated on each side, the lateral borders being straight and converging below.

Head, thorax, and petiole subopaque, very finely shagreened; mandibles, clypeus, and frontal portion of head, and especially the

frontal area, more shining. Mandibles densely striated and coarsely punctate. Legs and gaster shining, the latter delicately and transversely shagreened, with the same peculiar luster as in *F. truncicola obscuriventris*.

Hairs golden yellow, short, obtuse, suberect and very sparse on the upper and lower surfaces of the head, thoracic dorsum, and gaster. Legs without erect hairs on the extensor surfaces; antennal scapes occasionally with a few short hairs on their anterior surfaces. Eyes hairless. Pubescence whitish, very short and sparse, visible on the antennae, pleurae, and gaster, but not concealing the shining surface of the gaster.

Mandibular teeth and gaster black; remainder of body and appendages deep red; antennal funiculi, legs, especially the tibiae, mandibles, and anterolateral corners of the head, darker and more brownish. Ocellar region and mesonotum slightly infuscated even in large workers, but there is no increased tendency to infuscation in the smaller workers.

Female. Length 4–5 mm.

Mandibles and clypeus like those of the worker, except that the latter is more convex and less prominently keeled. Head slender, without the mandibles distinctly longer than broad, with long, anteriorly converging cheeks. Thorax distinctly narrower than the head. Petiole similar to that of worker but with sharper superior border, often slightly notched in the middle. Gaster small. Legs slender. Wings somewhat longer than the body (5.3 mm.).

Body smooth and shining, very finely shagreened, posterior portion of head and mesonotum more opaque; gaster very glabrous, being much more delicately shagreened than in the worker.

Hairs golden yellow, subereet, slender, pointed, much longer than in the worker and more abundant, especially on the upper surface of the head and thorax. Legs with rather long, scattered, subappressed hairs. There are a few conspicuous erect hairs on the anterior surface of the antennal scapes, on the gula and border of the petiole. On the gaster the long hairs are sparse and arranged in three regular rows on the first and second, in two rows on the succeeding segments.

Mandibular teeth and gaster black, remainder of body dull yellowish red. Antennae, legs, posterior portion of head, mesonotum, scutellum, and metanotum decidedly darker. The anteromedian and parapsidal blotches are faintly indicated on the mesonotum. Wings rather opaque, grayish hyaline, with fuscous veins and black stigma.

Male. Length 6.5–7 mm.

Mandibles pointed, edentulous. Head short, broadest through the eyes, which are large. Posterior corners broadly rounded; cheeks short, flattened, converging in front. Clypeus carinate in front, depressed behind. Thorax just in front of the wings hardly broader

than the head through the eyes. Base of epinotum with a median longitudinal impression, metanotum concave. Petiole very thick and blunt above, anterior and posterior surfaces both convex, border with a faint median notch.

Head, thorax, legs, and antennae subopaque, finely shagreened; mandibles, clypeus, frontal area, vertex, and scutellum shining as are also the petiole and especially the gaster.

Hairs and pubescence grayish, the former short and erect on the clypeus, thorax, gaster, and legs; the latter sparse and indistinct except on the antennae and legs. Eyes almost imperceptibly hairy.

Black; mouthparts, legs, and genitalia fuscous. Wings like those of the female but of a slightly darker tint.

Host (Temporary). Probably *F. neogagates*.

Type locality.— Connecticut: Colebrook, 1,400 ft. (Wheeler).

Massachusetts: Stony Brook Reservation, Chestnut Hill, near Boston (Wheeler).

Illinois: Black Hawk Springs, near Rockford (Wheeler).

The female *nepticula* resembles the female *nevadensis*, but differs in having much fewer erect hairs on the antennal scapes and body and, owing to the nearly complete absence of grayish pubescence, a more shining head and thorax. Moreover, the head, thorax, and appendages are decidedly darker and less red than in *nevadensis*. The worker *nepticula* may be readily confounded with that of *F. truncicola obscuriventris* owing to both forms having the same color and the same luster of the gaster, but *nepticula* is of average smaller size, has much sparser, coarser, and more obtuse hairs, the border of the clypeus is more projecting, and the epinotum is much lower and rounder.

F. nepticula is, in my experience, a rare ant. It nests in open woods under stones, the edges of which it banks with vegetable detritus. The colonies are rather small. The males and diminutive females make their appearance early in July.

63. F. difficilis Emery.

F. pallidefulva Mayr (*nec* Latreille), Verh. Zool. bot. ver. Wien, 1866, **16**, p. 889, ♀.

F. rufa subsp. *difficilis* Emery, Zool. jahrb. Syst., 1893, **7**, p. 651, pl. 22, figs. 9, 14, ☿ ♀ ♂.

F. difficilis Wheeler, Bull. Amer. mus. nat. hist., 1904, **20**, p. 348; Ibid., 1906, **22**, p. 63.

Worker. Length: 3.5–5.5 mm.

Head, excluding the mandibles, slightly longer than broad, slightly

broader behind than in front, with feebly convex posterior and lateral borders. Clypeus carinate its entire length, with the anterior border angularly projecting. Mandibles 8-toothed. Frontal area triangular, as long as broad. Frontal carinae strongly diverging. Antennae slender, basal funicular joints longer and more slender than the apical joints. Maxillary palpi rather short. Pro- and mesonotum not very convex, mesoëpinotal constriction rather shallow, base of epinotum convex, declivity flat, very sloping, and forming a rounded obtuse angle with the base. Petiole narrow, thick, with more convex anterior, and less convex posterior surface and blunt border, which when seen from behind is broadly rounded and not produced upward in the middle. Gaster of the usual shape; legs rather slender.

Opaque; mandibles, clypeus, and front of head slightly shining; frontal area subopaque. Mandibles very finely and densely striated.

Erect hairs very sparse, short, blunt, clavate, present on the front, clypeus, ocellar region, gula, upper surface of the pro- meso- and epinotum, and gaster. Antennal scapes and legs without oblique or suberect hairs. Pubescence grayish, sparse and fine on the head, thorax and appendages, denser on the gaster and concealing the surface so that this region appears gray.

Head, thorax, and petiole bright red or orange red; gaster dark brown with the base of the first segment and the anal region red or yellow. In small specimens the posterodorsal portions of the head and the dorsal portions of the thorax and petiole are more or less infuscated. Even in the largest workers the ocellar triangle is fuscous.

Female. Length 4–5.5 mm.

Head very much like that of the worker. Whole surface of body smoother and a little more shining. Hairs much longer and more abundant, present also on the posterolateral corners of the head. Pubescence yellow, very fine but distinctly visible on the upper surface of the head and thorax, and thick enough on the gaster to obscure the shining surface.

Reddish yellow throughout, only the eyes, mandibular teeth and wing insertions black. Wings grayish hyaline, more infuscated towards their bases. Veins and stigma pale brown.

Male. Length 5.5–6 mm.

(After Emery). Mandibles strongly dentate. Head short, broadest through the eyes which are large, behind the eyes broadly convex. Black; antennal funiculi usually brown, mandibles, legs, and genitalia paler yellow, femora often daker, coxae brown. Wings pale grayish, with dark veins.

Host (Temporary). Probably *F. schaufussi* or one of its varieties.

Type locality.— Virginia: (Th. Pergande).

North Carolina: Black Mts., Swannanoa Valley (W. Beutenmüller).

New Jersey: Lakehurst, Halifax (Wheeler); Brown's Mills Junction (W. T. Davis).

New York: Bronxville (Wheeler).

This ant, originally described as a form of *rufa*, occurs sporadically in open mountainous woods from New York state to North Carolina and probably somewhat further south along the Alleghanies. It nests under stones, which it banks with vegetable detritus. The colonies are often moderately large.

64. F. DIFFICILIS var. CONSOCIANS Wheeler.

F. difficilis var. *consocians* Wheeler, Bull. Amer. mus. nat. hist., 1904, **20**, p. 371, ☿ ♀ ♂; Ibid., 1906, **22**, p. 50.

WORKER. Length 3.5–5.5 mm.

Closely resembling the typical form, but the erect hairs more abundant and slightly longer, especially on the front, gula, and thorax. There are also numerous hairs on the posterolateral corners of the head, which are nearly always lacking in the typical *difficilis*. The petiolar border is somewhat sharper and the frontal area is smoother and more shining.

FEMALE. Length 4–5.5 mm.

Differing from the female of the typical *consocians* in having the pubescence and pilosity more abundant. The former is rather dense so that the whole body except the anterior portion of the head appears much less shining. The tibiae have long, scattered, oblique or suberect hairs which are lacking in the typical *difficilis*. Wings grayish hyaline, darker at the base.

MALE. Length 5.5–6.5 mm.

Mandibles broad, usually edentate, but occasionally with minute teeth at the base. Clypeus sharply carinate. Petiole thick, transverse, its anterior surface angularly convex, its posterior surface more flattened, its border obtuse, seen from behind broadly rounded and entire.

Body subopaque, head and gaster somewhat more shining. Mandibles coarsely punctate. Frontal area smooth and shining.

Hairs yellowish, erect, rather abundant on the head, mesonotum and petiole, sparse on the pleurae and upper surface of the gaster. Tibiae with a few small oblique hairs. Eyes hairless. Pubescence rather long and conspicuous on the thorax and gaster, shorter and sparser on the head, dense and very fine on the legs.

Head and thorax black; mandibles, antennae, petiole, and gaster dark brown; legs and genitalia light yellow; fore femora sometimes slightly infuscated. Wings grayish hyaline, distinctly infuscated towards their bases; veins and stigma brown.

Host (Temporary). *F. schaufussi* var. *incerta.*

Type locality.— Connecticut: Colebrook, (Wheeler).

Massachusetts: Woods Hole, Ellisville, Forest Hills, Blue Hills (Wheeler).

The habits of this variety are very similar to those of the typical form. Its young colonies are not infrequently found mixed with *F. incerta* and, as I have shown in former papers, the recently impregnated queens establish their formicaries with the aid of this species. The characters which separate *consocians* from the typical form are very slight and refer mostly to the pilosity. I believe, however, that they will prove to be valid. The variety is evidently a more boreal form of the species.

65. F. morsei Wheeler.

F. morsei Wheeler, Psyche, 1906, **13**, p. 39, fig. ♀ .

Worker. Length 3.5–5.5 mm.

Mandibles 8-toothed. Palpi rather long. Head, excluding the mandibles, distinctly longer than broad; cheeks long, slightly flattened converging in front; posterior border and angles convex and rounded. Clypeus convex, carinate, with rounded anterior border. Antennae slender; four basal joints of funiculi longer and more slender than the penultimate joints. Thorax in profile with deep mesoëpinotal constriction, convex pro- and mesonotum and the epinotum with distinct base and declivity, the former convex and rounded, the latter flattened and sloping. Petiole narrow, its anterior and posterior surfaces alike convex in profile, its border rather blunt; seen from behind the border is broadly rounded, in some specimens faintly excised on the middle, but not produced upward. Gaster large. Legs rather long.

Mandibles subopaque, coarsely striatopunctate. Anterior portion of head, clypeus, frontal area, lower surface of thorax, and gaster smooth and shining; remainder of body subopaque, very finely shagreened; upper surface of gaster with a slightly oily luster.

Hairs white, short, obtuse, suberect, and very sparse on the upper surface of the head, thorax, and gaster; nearly always absent on the gula and petiolar border. Femora and tibiae naked, the latter with a row of tapering hairs on their flexor surfaces. Pubescence white, extremely short and sparse, so that it is almost invisible, except on the upper surface of the gaster.

Reddish yellow; borders of mandibles black; anterior border of clypeus, vertex, upper surface of pro- and mesonotum, femora, tibiae, apical antennal joints, and gaster more or less infuscated; anal region

yellow. In many specimens the upper surface of the head is more reddish than the remainder of the body but there is little difference in coloration between the smallest and largest workers.

TYPE LOCALITY. — Massachusetts: South Natick (A. P. Morse).

The position of this species is problematic, as the female is unknown, but the characters of the worker certainly ally it to the preceding forms of the *microgyna* group. It differs from all of these species in its peculiar color and sculpture, the greater convexity of the posterior portion of the head and the shape of the petiole. It must be a rare species as I have been unable to find it again, even with Mr. Morse's assistance, in the type locality.

Exsecta Group.

66. F. EXSECTOIDES EXSECTOIDES Forel.

F. integra Mayr, Verh. Zool. bot. ver. Wien, 1862, **12**, p. 70; Ibid., 1886, **36**, p. 425, ♀ ♂ (*nec* Nylander).

F. exsectoides (Forel) McCook, Trans. Amer. ent. soc., 1877, **6**, p. 252–296, figs. 2–5, pls. 2–6; Proc. Acad. nat. sci. Phila., 1877, p. 135; Amer. natur., 1878, **12**, p. 431–345, 8 figs.; Proc. Acad. nat. sci. Phila., 1879, p. 154–156.

F. exsectoides Forel, Ann. Soc. ent. Belg., 1886, **30**, C. R. p. xxxviii, ☿ ♀; Dalla Torre, Catalog. Hymen., 1893, **7**, p. 195; Emery, Zool. jahrb. Syst. 1893, **7**, p. 653, pl. 22, fig. 6; Wheeler, Bull. Amer. mus. nat. hist., 1906, **22**, p. 71, 403–413, pls. 43–48.

WORKER. Length 4.5–7.5 mm.

Mandibles with the apical border 8-toothed, the basal border with two or three minute and often very indistinct or obsolete denticles. Head, excluding the mandibles as broad as long, a little narrower in front than behind, with deeply excised posterior and nearly straight lateral borders. Front convex, vertex flattened. Clypeus strongly carinate, with anterior border entire and angularly projecting in the middle. Frontal area distinct, frontal carinae moderately diverging. Antennae slender, scapes not thickened towards their tips, funiculi with the four basal joints somewhat longer and more slender than the penultimate joints. Maxillary palpi moderately long, 6-jointed. Pro- and mesonotum distinctly flattened above, mesoëpinotal constriction rather shallow; epinotum with subequal base and declivity, each straight in profile and meeting at a rounded obtuse angle. Petiole high and broad, compressed anteroposteriorly, with flattened anterior and posterior surfaces, and sharp, cultrate border, which, seen from

behind, is entire and usually broadly rounded, or slightly produced upward in the middle. Gaster of the usual shape, legs rather long.

Body delicately shagreened; head, thorax, and petiole subopaque or slightly shining; mandibles and frontal area more shining, the former striatopunctate, the latter rather smooth; gaster shining but more distinctly shagreened than the head and thorax.

Hairs and pubescence yellowish, very sparse. There are a few hairs on the clypeus, mandibles, and sometimes on the front, and blunt scattered hairs on the gaster. Eyes hairless. Pubescence short and very dilute, most distinct on the gaster. Legs without erect hairs, invested with very fine, dilute pubescence.

Deep red; gaster black, anal region reddish; mandibles, legs, vertex, funiculi and dorsal portions of thorax sometimes brownish or dark red.

Female. Length: 9–11 mm.

Head resembling that of the worker, but more flattened at the vertex, scarcely broader than the thorax. Petiole broader than that of the worker but similar in shape.

Head and thorax somewhat more shining than in the worker; mandibles superficially striated and coarsely punctate.

Hairs tawny, long, coarse, flexuous, and sparse, confined to the posterior portion of the pronotum and the gaster. There are also two small tufts of these hairs on the mesonotum, and several on the scutellum and clypeus. The pubescence is even more feebly developed than in the worker, being almost absent on the gaster.

Color like that of the worker, except that the gaster has a more reddish tinge and a yellow spot at the base of the first segment. Wings uniformly brown, with brown veins and stigma.

Male. Length 7.5–10 mm.

Mandibles with broad blades, distinctly 4-toothed. Eyes large. Head broad behind, with straight posterior border and large posterior corners, narrow in front, with short, straight cheeks. Clypeus sharply carinate, with broadly rounded anterior border. Maxillary palpi 5-jointed. Thorax robust. Petiole a little higher than long, thick, with flattened anterior and posterior surfaces, and very blunt, entire superior border.

Head, mandibles, thorax, and petiole subopaque; gaster shining. Mandibles coarsely striato-punctate.

Hairs few and scattered, confined to the upper surface of the head and thorax. Pubescence long, grayish, conspicuous and rather dense on the head, thorax, and gaster.

Black; mandibles, and antennae brown, genitalia brownish yellow; legs, including the coxae, light yellow. Wings brown as in the female, with brown veins and stigma.

Host (Temporary). *F. fusca* var. *subsericea*.

Type locality.— New Hampshire (Forel).

New Hampshire: Canobie Lake (G. B. King); Franconia (Mrs. A. T. Slosson); Raymond (W. Reiff).

Georgia: Rabun Bald Mountain (W. T. Davis).

North Carolina: Black Mountain (Forel).

Maryland: Baltimore (E. A. Andrews); Prince George County (W. T. Davis).

New Jersey: Newfoundland (W. T. Davis and Wheeler); Palisades; Alpine (W. Beutenmüller); Westfield, Scotch Plains, Halifax, Paterson (Wheeler); Tenafly (G. v. Krockow).

Pennsylvania: Hollidaysburg, Warrior's Mark, etc., (H. C. McCook); Lehigh Water Gap, Beatty (P. J. Schmitt).

New York: Staten Island (W. T. Davis); Ramapo Mts., Bronxville (Wheeler); West Farms (J. Angus); Garrison-on-Hudson (T. D. A. Cockerell).

Connecticut: Branford, North Haven, New Haven (H. L. Viereck); New Hartford, Stafford (W. E. Britton); Cromwell, Hartford (Forel); Colebrook (Wheeler).

Massachusetts: Sherborn, Wellesley (A. P. Morse); Essex County, Mt. Tom (G. B. King); Lowell, Tyngsboro (F. Blanchard); Lake Pleasant (Carey); Warwick (Miss Edwards); Woods Hole, Forest Hills, Blue Hills (Wheeler); Worcester (Forel).

Maine: Ogunquit (H. S. Pratt); South Harpswell (Wheeler).

Illinois: (M. C. Tanquary).

Wisconsin: Prairie du Chien (H. Muckermann).

Ontario: Toronto (R. J. Crew).

Nova Scotia: Round Hill (Centr. Exp. Farms Coll.).

This is the well-known "mound-building ant of the Alleghenies," the habits of which were described many years ago by Rev. H. C. McCook, who studied its huge colonies (one of them comprising some 1,600 nests!) in the mountains of Pennsylvania. The nests are large conical mounds, often 2.5 ft. high and 9.5 ft. in convex diameter, consisting very largely of earth, and erected in clearings in the woods. I have shown that the females establish their colonies by temporary parasitism in small colonies of *F. fusca* var. *subsericea*. Old colonies are frequently extinguished or compelled to move to new quarters by the growth of a carpet of moss (*Polytrichum commune*) over the surface of the nest. *F. exsectoides* is a very fierce ant and furiously attacks any intruder on its preserves. It kills other ants by decapitating them, a habit which seems to be peculiar to the members of the *exsecta* group.

67. F. EXSECTOIDES EXSECTOIDES var. DAVISI, var. nov.

WORKER. Length 4.5–7.5 mm.

Differing from the worker of the typical form only in having the posterior portion of the head and the dorsal portion of the pro- and mesonotum distinctly infuscated, at least in many of the workers of all sizes in the colony.

FEMALE (DEÄLATED). Length 9–11 mm.

Gaster red like the thorax and head and transversely banded with black, owing to the anterior and posterior border of each segment being of this color.

Described from a number of workers and deälated females taken at Newfoundland, N. J., by Mr. Wm. T. Davis. I have also taken this same form at Natick, Mass. Its validity as a variety will have to be tested by further study of the species. Possibly the color of the gaster in the queens is due to old age. It is, however, constant in twenty-one specimens taken from twelve different nests in New Jersey and fully thirty females from as many nests in Massachusetts.

68. F. EXSECTOIDES EXSECTOIDES var. HESPERIA, var. nov.

WORKER. Length 4.5–6 mm.

Differing from the typical form in the shape of the petiole, which is much narrower, lower and thicker, with the anterior surface convex, the posterior flattened, and the border, though sharp, not being blade-like, or cultrate. Seen from behind it is truncated and like the petiole of *F. dakotensis* in outline. The posterior corners of head, ocellar triangle, and a spot on the pro- and mesonotum fuscous. The red color of the body is a little more brownish and the legs darker than in the typical form. Frontal area rather opaque.

Described from twenty-eight workers which I took from a single colony nesting under a cluster of stones in Cheyenne Canyon, near Colorado Springs, Colo.

69. F. EXSECTOIDES OPACIVENTRIS Emery.

F. exsectoides var. *opaciventris* Emery, Zool. jahrb. Syst., 1893, **7**, p. 653, ♀ ; Wheeler, Bull. Amer. mus. nat. hist., 1906, **22**, p. 405.

WORKER. Length 4.5–6 mm.

Differing from the typical *exsectoides* in having the antennal scapes distinctly thickened at their tips and in the greater abundance of the

hairs and pubescence. There are prominent golden yellow hairs on the clypeus, front, and vertex and on the dorsum of the pro- and mesonotum, and the hairs on the gaster, which are also golden or fulvous, are coarser. The pubescence is grayish and denser on all parts of the body but especially on the gaster. This region is also more coarsely shagreened and therefore subopaque or opaque and not shining. The funiculi and the tips of the scapes are fuscous, in other respects the color is like that of the typical form.

Male. Length 7.5 mm.

Differing from the male of the typical *exsectoides* in having the thorax and gaster invested with longer pubescence and the mesonotum and scutellum covered with more abundant subappressed hairs. Eyes hairy. The single rather immature specimen examined has bidentate mandibles. The petiole is broadly excised in the middle and its margin has the form of a pointed, compressed tooth on each side of the excision.

Type locality.— Colorado: Breckenridge (Emery).

Colorado: Boulder (P. J. Schmitt and Wheeler); Florissant (Wheeler).

This is, in my opinion, a sharply marked subspecies and not a mere variety. It is readily distinguished from the typical form also in its habits. Its nests resemble those of the eastern form in size and shape, but are made of earth and pebbles instead of earth and vegetable detritus. At least this was the case with several nests which I saw at Florissant. When these nests were situated near the railroad track they were covered also with locomotive cinders which the ants had carefully collected. All the nests examined were in open country, not in woods.

70. F. ulkei Emery.

F. ulkei Emery, Zool. jahrb. Syst., 1893, **7**, p. 653, pl. 22, fig. 7, ♀ ; Wheeler, Ants, 1910, p. 446, 570.

Worker. Length 3.5–6 mm.

Mandibles with 8 teeth on the apical and a few indistinct denticles on the basal margin. Head, excluding the mandibles, distinctly longer than broad, very slightly narrower in front than behind, with broadly and deeply excised posterior border and rather straight sides. Front convex, vertex less flattened than in *exsectoides*. Clypeus carinate, but less acutely than in *exsectoides*, its anterior margin, angularly produced. Frontal area triangular, a little broader than long; frontal carinae at first diverging posteriorly but at their posterior

ends more nearly parallel. Maxillary palpi rather long, 6-jointed. Antennal scapes distinctly incrassated at their tips; joints 2–4 of the funiculi a little more slender, but scarcely longer than the penultimate joints. Pro- and mesonotum distinctly depressed or flattened above; mesoëpinotal impression shallow and broad at the bottom; epinotum with the base a little shorter than the declivity, the former slightly convex in profile and passing through a rounded angle into the sloping declivity. Petiole high and rather broad, much compressed anteroposteriorly, the anterior surface somewhat convex, the posterior flat, the upper border cultrate and sharp; seen from behind the sides are straight and diverge upward and the superior border is horizontal and entire.

Surface of body very finely shagreened, head and gaster shining, thorax subopaque; mandibles finely striatopunctate; frontal area subopaque; surface of gaster finely and sparsely punctate and transversely shagreened, with the sheen of the gaster of *exsectoides*, *obscuriventris*, and *nepticula*, but slightly less shining.

Hairs golden yellow, sparse and coarse, present on the clypeus, front, vertex, pro- and mesonotum, fore coxae, and gaster; slightly shorter on the gaster than in *exsectoides*, long on the venter. Pubescence very fine and sparse, most clearly visible on the gaster and legs.

Light or dark ferruginous red, legs a little darker, and more brownish; gaster, posterior half of head, a large spot on the pronotum, and a small one on the mesonotum, black.

Female. Length 7.5–9 mm.

Smaller than the female of *exsectoides*. Resembling the worker in color, but the tips of the scapes, the pleurae, bases of fore coxae and three large spots on the thorax are dark brown, and the surface of the body, especially of the head and thorax, is more glabrous and shining. The clypeus is ecarinate, with the anterior border depressed, the mandibles rather superficially striatopunctate.

The pilosity of the head is like that of the worker, but the hairs on the remainder of the body are very different. The pronotum, mesonotum, scutellum, upper pleurae, and gaster are covered with sparse, very long and coarse, appressed, tawny hairs. The border of the petiole also bears a number of these peculiar hairs. Wings uniformly tinged with brown, with pale brown veins and stigma.

Male. Length 7–8 mm.

Head like that of the male *exsectoides*, with straight posterior border, but with somewhat more broadly elliptical eyes. Mandibles edentate, narrow, and pointed. Thorax and gaster, robust, the latter flattened and rather broad. Petiole thick and low, with blunt, entire, transverse border.

Whole body more shining and more finely shagreened than in *exsectoides*.

Pubescence grayish, much shorter and sparser, especially on the head and thorax. Hairs of the same color, but longer and more abundant than in *exsectoides*, though restricted to the upper surface of the thorax, praesternum, and tip of gaster. Eyes hairless.

Head, including the mandibles and antennae, thorax, petiole, and gaster of a deeper black than in *exsectoides;* legs and genital appendages of a more reddish yellow, with the bases of the femora on the flexor surface and the tips of genital valves blackish. Wings slightly paler than in *exsectoides*.

Host (Temporary). Probably *F. fusca*.

Type locality.— South Dakota: Hill City (T. Ulke).

Illinois: Chicago (M. C. Tanquary).

Nova Scotia: Bedford, Port Maitland (W. Reiff); Middleton, Round Hill (Centr. Exper. Farms Coll.); Delhaven (Cornell Univ. Coll.); Ship Harbor (S. Henshaw).

New Brunswick: Fredericton (J. D. Tothill).

The female and male are described from Nova Scotia and New Brunswick specimens respectively. This species is evidently peculiar to the Canadian fauna and so rare in the transition zone that I have never had the good fortune to find one of its colonies. Mr. J. D. Tothill, who has been studying its habits in New Brunswick, has kindly given me photographs and a description of its nests. These are flattened mounds, a foot or somewhat more in diameter, made of earth and considerable vegetable detritus, and therefore seem to be much more like the nests of *exsecta* than those of *exsectoides*. In the coloration of the worker, the shape of its head, the small size of the female and the sculpture of the male, *ulkei* also approaches the European species, but its strongest morphological affinities are nevertheless with *exsectoides*.

71. F. ulkei var. hebescens, var. nov.

Worker. Length 4.5–6 mm.

Differing from the typical form in sculpture and coloration. The shagreening of the gaster is much sharper so that this region is subopaque or only slightly shining. The anterior half of the head and the thorax, petiole, and legs are more brownish red than in the typical form, while the gaster and posterior half of the head are brown instead of black, and the spots on the thorax are paler.

Type locality.— Indiana: Bass Lake, Stark County (W. S. Blatchley).

Fig. 5.— Distribution of the Nearctic forms of the *Formica exsecta* group.

Indiana: Tippecanoe Lake (W. S. Blatchley).

Nova Scotia: Digby (J. Russell).

Described from a large number of specimens, all agreeing in the characters noted above.

72. F. EXSECTA EXSECTA Nylander.

F. exsecta Nylander, Acta Soc. Fennica, 1846, **2**, p. 909, pl. 18, fig. 20, ☿ ♀ ♂; Ann. sci. nat. Zool., 1856, ser. 4, **5**, p. 63, pl. 3, fig. 7, ☿ ♀ ♂; Förster, Hymen. stud., 1850, **1**, p. 23, ☿ ♀ ♂; Mayr, Verh. Zool. bot. ver. Wien, 1855, **5**, p. 340, ☿ ♀ ♂; Europ. Formicid., 1861, p. 46–48; Forel, Denks. Schweiz. gesell. Naturw., 1874, **26**, p. 51, ☿ ♀ ♂; Ern. André, Spec. Hymén. Europ., 1882, **2**, pt. 14, p. 178, 185, 188; Dalla Torre, Catalog. Hymen., 1893, **7**, p. 195; Ruzsky, Formicar. Imper. Ross., 1905, p. 353, figs. 67, 68; Emery, Deutsch. ent. zeitschr., 1909, p. 189, fig. 5; Ibid., 1912, p. 672.

WORKER. Length 5–7.5 mm.

Mandibles 8-toothed, with additional indistinct denticles on the basal margin. Head longer than broad, narrowed somewhat at the posterior corners so that it is here no broader than at the anterior border; posterior border deeply excised. Front convex; clypeus sharply carinate, without a distinct, transverse depression behind its anterior border. Maxillary palpi long, 6-jointed. Pro- and mesonotum not very convex; mesoëpinotal constriction shallow, broad at the bottom. Spiracles of metanotum prominent. Epinotum rounded, without distinct base and declivity. Petiole narrow, strongly compressed anteroposteriorly, its superior margin thin, sharp, and very deeply excised.

Opaque or slightly shining. Mandibles finely striated and coarsely punctate.

Hairs very sparse, distinct on the gaster, where they are short and obtuse. Pubescence yellow, moderately abundant, especially on the head, prothorax, and gaster, longest on the cheeks. Eyes hairless.

Red or sordid yellowish red; clypeus and appendages darker, posterodorsal portion of head, a large spot on the pronotum and often also a small one on the mesonotum, brown; gaster blackish brown, base of first segment red or yellow.

FEMALE. Length 8–9.5 mm.

Resembling the worker. Anterior border of clypeus straight in the middle. Thorax with flattened mesonotum and scutellum. Petiole much broader, flatter, and more deeply excised than in the worker.

Sculpture much as in the worker. Hairs more abundant especially on the mesonotum, posterior border of pronotum, and front of head. Pubescence longer but sparse, conspicuous both on the body and appendages.

Ferruginous red; top of head, posterior border of pronotum, the mesonotum, scutellum, metanotum, and gaster dark reddish brown. Wings brownish hyaline, with pale brown veins and stigma.

Male. Length 6–9 mm.

Head rather small, with broadly excised posterior margin. Eyes large. Mandibles pointed, edentate, and rather narrow. Maxillary palpi as in the worker and female. Petiole low, somewhat compressed, with blunt, broadly excised border.

Body rather shining, especially the gaster.

Hairs shorter than in the female, most abundant and distinct on the head and thoracic dorsum. Eyes hairy. Pubescence short, most distinct on the upper surface of the gaster.

Black; legs and genitalia brown, femora somewhat darker. Wings colored as in the female.

Host (Temporary). *F. fusca.*

North and Middle Europe; Alps, Caucasus, Siberia, Altai Mountains.

Lives in woods and builds flattened mound nests covered with finer plant débris than those of *rufa* and *pratensis*. Single colonies often occupy more than 100 nests which are connected with one another by runways and may cover a considerable area.

73. F. exsecta exsecta var. rubens Forel.

F. exsecta var. *rubens* Forel, Denks. Schweiz. gesell. naturw., 1874, **26**, p. 51, ☿ ; Ern. André, Spec. Hymén. Europe, 1882, **2**, pt. 14, p. 179; Dalla Torre, Catalog. Hymen., 1893, **7**, p. 195; Ruzsky, Formicar. Imper. Ross., 1905, p. 358; Emery, Deutsch. ent. zeitschr., 1909, p. 191, ☿ .

Worker. Differs from the typical *exsecta* only in color, the body being pale red, with a small spot on the vertex and the gaster, except its base, brown.

This form is known only from the Swiss Jura and Southern Russia. I am inclined to include under it also a number of workers which I took at Zermatt, Switzerland. In these the spot on the head is not smaller than in the typical form but much paler.

74. F. exsecta exsecta var. etrusca Emery.

F. exsecta var. *etrusca* Emery, Deutsch. ent. zeitschr., 1909, p. 191, ☿ .

Worker. Length 5–6.5 mm.

Maxillary palpi a little shorter than in the typical *exsecta*. Dark red, the brown color on the head more extensive. Legs, or at least

the tibiae, brown. Petiole remarkably broad, its superior border rounded, entire or only slightly excised.

Italy: Pracchia and Abetone in the Apennines (C. Emery).

75. F. EXSECTA PRESSILABRIS Nylander.

F. pressilabris Nylander, Acta. Soc. Femnica, 1846, **2**, p. 911, pl. 18, fig. 21, ☿ ♀ ♂; Meinert, Naturv. abh. Dansk. vid. selsk. (5) **5**, 1860, p. 45, ☿ ♀ ♂; Dalla Torre, Catalog. Hymen., 1893, **7**, p. 205, (*in part*).

F. exsecta subsp. *pressilabris* Ruzsky, Formicar. Imper. Ross., 1905, p. 363, figs. 69, 70; Emery, Deutsch. ent. zeitschr., 1909, p. 191, fig. 5; Ibid., 1912, p. 672.

WORKER. Length 3.8–6.5 mm.

Maxillary palpi very short, 5-jointed, or 6-jointed, according as the fourth joint is more or less distinctly separated into two small joints. Clypeus with a transverse impression just behind and parallel with its somewhat reflected anterior border. Front convex anteriorly, depressed behind.

Sculpture very fine and superficial. Gaster, especially at the base, lustrous.

Pubescence very short and sparse.

Red portions of body darker than in the typical *exsecta*, the dark spots more extensive, antennae and legs often brown.

FEMALE. Length 6–7.5 mm.

Much smaller than the female of the true *exsecta* and very shining. Palpi as in the worker. Pubescence extremely short and sparse. Dark brown, anterior portion of head, ventral and lateral portions of thorax, mesonotum in part, petiole below, and tip of gaster, often also the femora and the scapes, paler or darker red.

MALE. Length 5–7.5 mm.

Smaller than the male of the typical *exsecta;* the posterior margin of the head more feebly excised; maxillary palpi as in the worker; eyes hairless.

HOST (TEMPORARY). *F. fusca.*

Northern Europe, Caucasus, Siberia, Turkestan, Ural Mountains.

76. F. EXSECTA PRESSILABRIS var. FORELI Emery.

F. pressilabris Mayr, Verh. Zool. bot. ver. Wien, **5**, 1855, p. 339, ☿ ♀ (*nec* ♀); Europ. Formicid, 1861, p. 46; Dalla Torre, Catalog. Hymen., 1893, **7**, p. 205 (*in part*).

F. exsecta st. *pressilabris* Forel, Denks. Schweiz. gesell. naturw., 1874, **26**, p. 55, ☿ ♀ ♂.

F. exsecta pressilabris var. *foreli* Emery, Deutsch. ent. zeitschr., 1909, p. 192, ☿ ♀ ♂.

Worker.

Differing from *pressilabris* in its less superficial sculpture and somewhat longer pubescence. The upper surface of the gaster is quite opaque at the base.

Female.

Somewhat more shining than the female of the typical *exsecta;* pubescence much longer and denser.

Male.

Indistinguishable from the male of *pressilabris.*

Distributed through Switzerland and probably also through the mountain regions of Central Europe. The nest mounds are small and more earth is used in their construction than in the nests of the typical *exsecta.* They are most frequently found in meadows, especially along the borders of hedges and woods. A single colony often inhabits several nests.

77. F. exsecta pressilabris var. exsecto-pressilabris Forel.

F. exsecta var. *exsecto-pressilabris* Forel, Denks. Schweiz. gesell. naturw., 1874, **26**, p. 52, 55, 57, ☿ ♀ ♂; Dalla Torre, Catalog. Hymen., 1893, **7**, p. 205; Emery, Deutsch. ent. zeitschr., 1909, p. 192.

Worker and Female.

The worker resembles the var. *forcli* more closely, especially in stature and in the length of the maxillary palpi. The female resembles the typical *exsecta,* especially in stature.

Switzerland; Vosges Mts.

The nests of this variety are described by Forel as being intermediate between those of *forcli* and the typical *exsecta.*

78. F. exsecta pressilabris var. rufomaculata Ruzsky.

F. exsecta pressilabris var. *rufomaculata* Ruzsky, Arb. Ges. naturf. Kasan, 1895, **28**, p. 13, ☿ ; Berlin. ent. zeitschr., 1896, **41**, p. 68; Formicar. Imper. Ross., 1906, p. 369; Emery, Deutsch. ent. zeitschr., 1909, p. 192.

Worker. Characterized by having the base of the first gastric segment with a red spot at the base. Legs yellowish brown.

Southeastern Russia.

79. F. suecica Adlerz.

F. suecica Adlerz, Öfvers. Vet. Acad. förhandl., 1902, p. 263, ☿ ♀ ♂.
F. exsecta subsp. *suecica* Emery, Deutsch. ent. zeitschr., 1909, p. 193, ☿ ♀ ♂.

WORKER. 4–6.3 mm.

Closely related to *F. exsecta*. Head proportionally broader, with less deeply excised posterior border and more rounded posterior corners, the cheeks rather convex, front depressed. Mandibles 8-toothed, with 2 or 3 minute additional teeth on the basal border. Clypeus indistinctly carinate, its anterior portion flattened and its border slightly reflected. Frontal area triangular, a little longer than broad. Maxillary palpi long, 6-jointed. Epinotum in profile not so rounded as in *exsecta*, distinctly angular, with distinct base and declivity, the former horizontal, very feebly convex, the latter very sloping. Petiole very much like that of *exsecta*, its margin sharp and deeply excised.

Head and gaster rather smooth and shining, finely shagreened. Frontal area smooth and shining.

Pilosity and pubescence very feebly developed, only the clypeus, mouthparts, venter, and tip of gaster with sparse hairs.

Head, thorax, and petiole ferruginous; front, vertex, and posterior portion of head, especially in small workers, often darker; antennal funiculi, anterior border of clypeus, dental border of mandibles, sometimes also the legs in part, brown; gaster blackish brown.

FEMALE. Length 5–6.3 mm.

Very small. Resembling the worker in the structure of the head; the thorax and petiole as in *F. exsecta*.

Body very shining, especially the head, thoracic dorsum, and gaster.

Pilosity and pubescence as in the worker.

Upper surface of head, posterior border of pronotum, mesonotum, scutellum, and border of petiole and gaster, except the anal region, blackish brown. Remainder of body darker or lighter yellowish or reddish brown. Wings very pale grayish hyaline, with pale brown veins and darker stigma.

MALE. Length 6–6.5 mm.

More slender than the male *exsecta;* posterior border of head broadly excised but sometimes indistinctly so. Mandibles broad, pointed, edentulous. Palpi as in the worker. Petiole low and thick, as broad as high, truncated above, with blunt, entire border.

More shining than the male of *exsecta*, especially the gaster. Frontal area and mandibles more shining than the remainder of the head.

Hairs and pubescence no more abundant than in the worker and female, even sparser on the gaster. Mesonotum with a few short, erect hairs. Eyes hairless.

Black; genitalia and legs yellowish, middle portions of femora and tibiae more or less infuscated. Wings pale grayish hyaline as in the female.

Sweden: Alnö Island, in the Gulf of Bothnia, near Sundsvall.

This form is regarded by Emery as an extreme race of *F. exsecta*,

but the differences of structure and habit seem to me to be sufficient to entitle it to the rank of a species, as it was originally described by Adlerz. According to this observer it does not build mound-nests like the typical *exsecta* and its subspecies and varieties but resembles *F. truncicola* in establishing its formicaries in rotten stumps or logs which it banks with fine vegetable detritus.

Fusca Group.

80. F. FUSCA FUSCA Linné.

F. fusca Linné, Syst. nat. ed. 10, 1758, **1**, p. 580; Fauna Suec., ed. 2, 1761, p. 426; deGeer, Mem. hist. ins., 1771, **2**, p. 1, pl. 42, figs. 12–15; Fabricius, Spec. ins., 1781, **1**, p. 490; Mantissa ins., 1787, **1**, p. 308; Olivier, Encycl. meth. insect., 1791, **1**, p. 493; Fabricius, Ent. syst., 1793, **2**, p. 352; Latreille, Essai hist. fourmis France, 1798, p. 39, ☿ ♀ ♂; Hist. nat. fourmis, 1802, p. 159, pl. 6, fig. 32, e ☿ ♀ ♂; Fabricius, Syst. Piez., 1804, p. 399; Latreille, Gen. Crust. ins. 1809, **4**, p. 126; Lepeletier, Hist. nat. insect. Hymén., 1836, **1**, p. 205, ☿ ♀ ♂; Westwood, Introd. mod. class. insects, 1840, **2**, Synop., p. 83; Nylander, Acta Soc. Fennica, 1846, **2**, p. 917, 919, ☿ ♀ ♂, pl. 18, fig. 23; Ibid., 1849, **3**, p. 27, 30; Förster, Stettin. ent. zeit., 1853, **14**, p. 141; F. Smith, Trans. Ent. soc. Lond., 1855, ser. 2, **3**, p. 104, ☿ ♀ ♂, pl. 9, fig. 15; Mayr, Verh. Zool. bot. ver. Wien, 1855, **5**, p. 346, ☿ ♀ ♂; Nylander Ann. sci. nat. Zool., 1856, ser. 4, **5**, p. 65, ☿ ♀ ♂; F. Smith, List Brit. anim. Brit. mus., 1858, pt. 6, p. 5, pl. 3, fig. 14; Meinert, Natur. abh. Dansk. vid. selsk., 1860, ser. 5, **5**, p. 44, ☿ ♀ ♂; Mayr, Europ. Formicid., 1861, p. 47–49, ☿ ♀ ♂; Taschenberg, Hymen. Deutschl., 1866, p. 239; Forel, Denks. Schweiz., gesell. naturw., 1874, **26**, p. 53, 56, 58, 356, ☿ ♀ ♂; Bull. Soc. Vaud. sci. nat., 1875, ser. 2, **14**, p. 60; Lubbock, Journ. Linn. soc. Zool., 1877, **13**, p. 217, pl. 17, fig. 3; Ern. André, Spec. Hymén. Europe, 1882, **2**, pt. 14, p. 182, 186, 190, pl. 5, fig. 12, ☿ ♀ ♂; Adlerz. Bih. Svensk. vet. akad. Handl., 1886, **11**, p. 286, 290, ☿ ♀ ♂; Wasmann, Deutsch. ent. zeitschr., 1887, **31**, p. 109; Dalla Torre, Catalog. Hymen., 1893, **7**, p. 196; Ruzsky, Formicar. Imper. Ross., 1905, p. 373, 1 fig.; Emery, Deutsch. ent. zeitschr., 1909, p. 193, ☿ ♀ ♂; Ibid., 1912, p. 672.

F. fusca var. *glacialis* Wheeler, Bull. Amer. mus. nat. hist., 1908, **24**, p. 624, ☿ ♀ ♂.

WORKER. Length 4–6.5 mm.

Body rather slender. Head longer than broad, narrower in front than behind, with straight posterior and lateral borders. Eyes large. Mandibles 8-toothed. Clypeus sharply carinate its entire length,

with entire, rounded, projecting anterior border. Frontal carinae moderately diverging behind. Antennae rather slender, the scapes slightly thickened towards their tips, the basal joints of the funiculus scarcely longer and but little more slender than the penultimate joints. Maxillary palpi moderately long. Thorax narrow; pro- and mesonotum but slightly convex, rather depressed above; mesoëpinotal constriction shallow; epinotum with subequal base and declivity, both straight in profile, the former horizontal, the latter sloping, meeting at a distinct but obtuse angle. Petiole narrow, cuneate in profile, with convex anterior and flattened posterior surface, its border rather sharp, entire and broadly rounded when seen from behind. Gaster small, legs rather slender.

Subopaque and very finely and sharply shagreened; mandibles coarsely striatopunctate; clypeus finely longitudinally striate. Frontal area subopaque, only the sutures surrounding it shining.

Hairs and pubescence whitish, the former short, erect, very sparse, confined to the upper surface of the head, thorax and gaster, coxae and venter. Eyes hairless. Pubescence dense on the head, thorax, and gaster, longest on the gaster, giving the surface a slightly pruinose, but not a silky appearance.

Black; mandibles, scapes, basal joints of funiculi, and legs deep red, femora and tibiae, except the knees, often darker.

Female. Length 7–10 mm.

Smaller than the females of *rufa*, but the gaster proportionally larger and more elliptical. Thorax broader than the head, which, excluding the mandibles, is as broad as long. Petiole compressed anteroposteriorly and broader than in the worker. Wings long.

Sculpture, pilosity, and color much as in the worker, except that the gaster is very smooth and shining, with much more dilute pubescence. Wings nearly colorless or very slightly yellowish; stigma brown.

Male. Length 8–10 mm.

Body slender. Mandibles narrow, pointed, often, if not always, denticulate. Head broad behind and considerably narrowed in front, with large eyes, straight posterior border and cheeks and rounded posterior corners. Clypeus convex, bluntly carinate. Thorax broader than the head. Petiole transverse, somewhat compressed anteroposteriorly towards the superior border, which is blunt and, seen from behind, with a broad and very shallow median excision. Gaster rather long and narrow. Stipes but little longer than the volsellae and sagittae.

Head and thorax, including the mandibles and frontal area, subopaque. Gaster distinctly shining.

Hairs and pubescence much as in the worker, the former absent on the upper surface of the gaster. Eyes hairless.

Black; gaster often more brownish; scapes and tips of mandibles

dark brown; legs and genitalia yellow. Bases of the coxae and sometimes also the last tarsal joint of each foot, black. Wings grayish hyaline, scarcely darker than in the female.

Widely distributed through North and Central Eurasia; but occurring only in mountainous country in Southern Europe and there often at considerable elevations (up to 2,400 meters in the Alps, according to Forel). This form is also widely distributed through Boreal America. I have examined specimens from the following localities: —

Newfoundland: Cod Roy and Bay of Islands (L. P. Gratacap); East Coast (W. T. Davis); Spruce Brook (Amer. Mus. Nat. Hist. Coll.).

Nova Scotia: Digby (J. Russell); Port Maitland (W. Reiff); Boisdale, Cape Breton (W. T. Davis).

New Brunswick: St. Stephen and St. Andrews (Centr. Exper. Farms Coll.).

Quebec: Point Comfort, James Bay (A. Skinner); Hull, Kingsmere (Wheeler).

Ontario: Rat Portage (J. C. Bradley); Guelph, Ottawa (Wheeler); Marshall's Bay near Arnprior (C. G. Hewitt).

Saskatchewan: Methy Lake (R. Kennicott).

British Columbia: Carbonate, on the Columbia River, 2,800 ft. (J. C. Bradley).

Maine: South Harpswell, Lower Goose Island, Casco Bay (Wheeler); Monmouth (Frost).

New Hampshire: Mt. Washington (Mrs. A. T. Slosson); Mt. Moosilauke, 1,500–3,000 ft. (Wheeler).

Vermont: Lyndon (A. L. Melander).

Massachusetts: Blue Hills, near Boston (Wheeler).

New York: Ramapo Mountains (Wheeler); Niagara Falls (Amer. Mus. Nat. Hist. Coll.).

North Carolina: Lake Toxaway (Mrs. A. T. Slosson); Black Mountains (W. Beutenmüller).

Michigan: Pequaming, Baraga County (M. Hebard); Isle Royale (H. A. Gleason).

Colorado: Cripple Creek, 10,200 ft. (Wheeler); Steamboat Springs (T. D. A. Cockerell).

Montana: Weeksville (S. Henshaw); Helena, Elkhorn, Nigger Hill, Powell County (W. M. Mann).

Idaho: Moscow (J. M. Aldrich).

Washington: Pullman (W. M. Mann).

On careful examination I am unable to detect any important differ-

ences between the form which I described as the var. *glacialis* from Maine and the true European *fusca*. The wings of the males and females in the American form are perhaps slightly darker, but the tint is variable in European specimens. The sculpture, color, and pubescence are identical in the two forms. The specimens from Newfoundland, including in all probability those from St. Pierre and Miquelon, Newfoundland, mentioned by Emery (Zool. jahrb. Syst., 1893, **7**, p. 660), and the specimens from Nova Scotia and New Brunswick agree very closely with the cotypes from Maine. The western forms are often a little more like *subsericea* in pubescence and may be regarded as transitional to that variety. Should it be possible on further study to detect any satisfactory differences between American and Eurasian specimens, the term *glacialis* would, of course, have to be reinstated.

The colonies of the American *fusca* are often much larger than those which I have seen in Europe. In both continents it nests under stones or logs or in rude craters or small earthen mounds. The workers are extremely timid. This timidity, which characterizes all the varieties and subspecies of *F. fusca*, together with its extreme fecundity, has made it an ideal host for a large number of the parasitic species of Formica of the *sanguinea*, *rufa*, *microgyna*, and *exsecta* groups.

81. F. FUSCA FUSCA var. GLEBARIA Nylander.

F. glebaria Nylander, Acta. Soc. Fennica, 1846, **2**, p. 917, ☿ ♀, taf. 18, fig. 23; Förster, Hymen. stud., 1850, **1**, p. 31, ☿ ♀ ♂.
F. fusca var. *glebaria* Emery, Deutsch. ent. zeitschr., 1909, p. 196, ☿ ♀; Karawajew, Rev. Russe ent., 1909, p. 268.
F. fusca subsp. *glebaria* Emery, Deutsch. ent. zeitschr., 1912, p. 672.

WORKER. Length 4–6.5 mm.

Differing from the typical *fusca* in color and pilosity. The body is deep brown or at any rate not deep black, and the pubescence is longer and more abundant, especially on the gaster, so that the body is distinctly silky. The front of the head, the sutures of the thorax, the scapes, and articulations of the legs are pale and more yellowish or reddish.

FEMALE. Length: 7–9 mm.

Resembling the worker in color and pilosity. The gaster is not smooth and shining as in the typical *fusca* but subopaque and covered with much denser pubescence and appearing glossy or silky. Wings distinctly infuscated at their bases.

MALE. Length 8–9 mm.

Apparently indistinguishable from the male of the typical form. Perhaps the pubescence on the gaster is a little longer and denser and this region therefore a little less shining. Wings as in the female.

Like *fusca* this variety is widely distributed through Eurasia. It has been introduced into gardens in Algiers. Emery states that it does not occur in the smaller southern islands in the Mediterranean and that it is absent from Crete. Krausse has recently taken it, however, in Sardinia. Unlike the true *fusca*, it prefers the lowlands and especially gardens and meadows, where it builds small mound-nests. If the ground is very dry the nests may be entirely subterranean like those of *F. rufibarbis*.

Emery has recently come to regard *glebaria* as a good subspecies, instead of as a mere variety of *fusca*, because he finds that the workers of the typical form of this species will not rear the pupae of *glebaria*. It is not at all clear that such behavior necessarily constitutes a criterion of the taxonomic status of a subspecies, since it will not hold even for species. Moreover, if *glebaria* is raised to subspecific rank it will be necessary to do the same with many of our American forms of *fusca*, such as *subsericea*, *neoclara*, *gelida*, etc., and I am not prepared to regard these as more than varieties.

82. F. FUSCA FUSCA var. RUBESCENS Forel.

F. fusca var. *rubescens* Forel, Bull. Soc. ent. Belg., 1904, **48**, p. 423, ☿ ; Emery, Deutsch. ent. zeitschr., 1909, p. 196, ☿ ♀.

WORKER. Length 4–6.5 mm.

Sculpture and pubescence as in *glebaria*. In the large worker the anterior portion of the head, the thorax, scapes, first funicular joint, and the legs are yellowish red, with the exception of two almost confluent fuscous spots resembling those of *F. pratensis*, on the pro- and mesonotum. The small workers are scarcely distinguishable from those of var. *glebaria*, the red color being very feebly developed or absent.

FEMALE. Length 7–9 mm.

Lower portions of thorax and the petiole more or less red, the color of the remainder of the body as in *glebaria*, the gaster subopaque and covered with short, silky pubescence. Wings distinctly infuscated at their bases.

MALE. Length 8–9 mm.

Indistinguishable by any reliable characters from the males of *fusca* and its var. *glebaria*.

This variety is known only from Central Europe. It is common in Switzerland, the type locality, inhabiting the same stations and nesting in the same manner as the var. *glebaria*. It is often confused with *F. rufibarbis* on account of its color, but this species usually lacks the dark spots on the thorax and is fierce and aggressive, whereas *glebaria*, like all the other varieties of *fusca*, is very timid.

83. F. FUSCA FUSCA var. JAPONICA Motschulsky.

F. japonica Motschulsky, Bull. Soc. nat. Moscou, 1866, **39**, p. 183, ☿.
F. fusca var. *nipponensis* Forel, Mitth. Schweiz. ent. gesell., 1900, **10**, p. 270, ☿; Mitth. Naturh. mus. Hamburg, 1901, **18**, p. 66, ♀; Ern. André, Bull. Mus. hist. nat. Paris, 1903, p. 128; Wheeler, Bull. Amer. mus. nat. hist., 1906, **22**, p. 323, ☿.
F. fusca var. *japonica* Emery, Deutsch. ent. zeitschr., 1909, p. 197, ☿ ♀.

WORKER. Length: 4–5.5 mm.

Head, thorax, and gaster opaque, rather coarsely shagreened. Mandibles coarsely striatopunctate. Legs slightly shining. Hairs and pubescence white, the former short, sparse, on the gaster stubby and obtuse, the pubescence very short, moderately dense and giving the surface a slightly pruinose appearance. Body black; mandibles, antennae, tarsi, sutures of thorax, and articulations of legs brown.

FEMALE. Pilosity, sculpture, and color as in the worker.

This ant appears to be common in Japan. Forel's specimens came from the Island of Yezo and from Tokio. I have seen specimens from Misaki, Kanagawa (1,700 ft.), Yamanaka, and Takakiyama. According to Emery, Ruzsky has recorded this variety also from Mongolia. It approaches the North American var. *subsericea* in some respects, but is peculiar in the dull opacity of the body.

84. F. FUSCA FUSCA var. SUBSERICEA Say.

F. subsericea Say, Bost. journ. nat. hist., 1836, **1**, p. 289, ☿ ♀; Ed. Leconte, 1859, **2**, p. 734, ☿ ♂, Dalla Torre, Catalog. Hymen., 1893, **7**, p. 213.
F. fusca Mayr, Verh. Zool. bot. ver. Wien, 1886, **37**, p. 426.
F. fusca var. *subsericea* Emery, Zool. jahrb. Syst., 1893, **7**, p. 659, ☿ ♀ ♂; Wheeler, Bull. Amer. mus. nat. hist., 1905, **21**, p. 401; Occas. papers Bost. soc. nat. hist., 1906, **7**, no. 7, p. 19.

WORKER. Length 4–7 mm.

Base of epinotum often slightly convex, longer than the sloping, slightly concave declivity. Head in the largest workers as broad

as long. Petiole in such workers often rather broad, with compressed, feebly notched superior border.

Sculpture of the body somewhat finer and more superficial than in the typical *fusca*, so that the body is a little more shining. Moreover, it often has a faint metallic luster.

Hairs and pubescence pale yellow or whitish, the hairs short, sparse and erect, as in the true *fusca*, the pubescence longer and denser, giving the body and especially the gaster a silky appearance. Legs and scapes with equally dense but shorter pubescence.

Black; mandibles, antennae, tarsi, and articulations of legs dull red or brown.

Female. Length 8–10.5 mm.

Large and stout. Like the worker in sculpture, pilosity, and color. Pubescence on the gaster even longer and more conspicuous. Legs more reddish. Wings uniformly and rather deeply infuscated.

Male. Length 9–10.5 mm.

Resembling the male of the typical *fusca*, larger and more robust, with the pubescence, especially on the gaster, much longer and more abundant and the wings deeply infuscated as in the female. The shagreening of the body is coarse, so that the surface is rather opaque and even the gaster is only very slightly shining.

Type locality.— Indiana.

Indiana: Camelton, Hammond, Vedensburg, Wyandotte, Vawter Park, Arlington, Pine, Culver, Tippecanoe Lake, Shoals, Bass Lake (W. S. Blatchley).

Illinois: Rockford (Wheeler).

Michigan: Ann Arbor (J. Dawson); Porcupine Mountains (O. McCreary); Isle Royale (H. A. Gleason).

Colorado: Manitou (Wheeler).

Arizona: Miller Canyon, Huachuca Mountains (Biederman).

Washington: Olympia (T. Kincaid).

Kansas: Lawrence.

Pennsylvania: White Haven (J. C. Bradley).

Georgia: Black Rock Mountain, Rabun County (J. C. Bradley).

North Carolina: Black Mountain (W. Beutenmüller).

Virginia: Ashland (J. F. McClendon).

New Jersey: Caldwell (E. T. Cresson); New Brunswick (J. B. Smith); Great Notch, Jamesburg, Ft. Lee, Lakehurst (Wheeler); Montclair (G. v. Krockow); Newark.

New York: Central Park, New York City; Saugerties, Bergen Beach (G. v. Krockow); Garrison-on-Hudson (T. D. A. Cockerell); Bronxville and Mosholu (Wheeler); Kiamesha (C. T. Brues); Ithaca (Cornell Univ. Coll.).

Connecticut: Suffield (Geo. Dimmock); Branford, Cheshire, Mt. Carmel, New Haven (H. L. Viereck); New Haven, Salisbury (W. E. Britton); Cromwell, Hartford (A. Forel); Winsted, Norfolk, Colebrook (Wheeler).

Rhode Island: Providence (Davis).

Massachusetts: Sherborn, Wellesley, Andover (A. P. Morse); Essex County, Mt. Tom, Springfield (G. B. King); Springfield (J. A. Allen); Arlington, Cambridge (Mus. Comp. Zoöl.); Readville, Woods Hole, Boston (Wheeler); Medford (W. H. Dall).

New Hampshire: Holderness (A. P. Morse); Canobie Lake, West Ossipie (G. B. King); Mt. Moosilauke, 1,700 ft. (Wheeler).

Vermont: Hyde Park.

Maine: South Harpswell, Sebascoegan Island, Casco Bay (Wheeler).

Nova Scotia: Digby (J. Russell).

Ontario: Toronto (R. J. Crew); Ottawa (Centr. Exper. Farms Coll.); Guelph, Port Stanley (W. H. Wright).

This is the most abundant Formica in temperate North America and one of the most abundant insects, next to *Lasius niger* var. *americanus*, at least in the Eastern United States. Its colonies, which are often rather large, nest in sunny places under stones or in low flat "beds," or mounds, often a meter or more in diameter. Owing to its great abundance, it is the favorite host of the Nearctic forms of the *sanguinea*, *rufa*, and *exsecta* groups. It is a very cowardly ant and rarely resents disturbance of its nests unless it happens to be acting as the "slave," or auxiliary of *sanguinea*. Although the pure form of *subsericea* may be readily recognized, there occur forms which in sculpture and pilosity connect it with the true *fusca* and with the varieties *subaeneseens* and *argentea*, and the workers of such forms are not always easy to identify.

85. F. FUSCA FUSCA var. ARGENTEA Wheeler.

F. fusca var. *argentata* Wheeler, Amer. nat., 1902, **36**, p. 952, *nota* ♀ ; Ants, 1910, p. 570.

F. fusca var. *argentea*, nom. nov. Wheeler, Psyche, 1912, **19**, p. 90.

WORKER. Length 4–7 mm.

Closely related to the var. *subsericea* but differing in the somewhat more slender body, longer legs, in the character of the pubescence, and in color. The pubescence is more glistening white and denser, so that the whole body has a silvery luster. The body is dark reddish brown or brownish black, instead of black, the mandibles, corners of

clypeus, anterior borders of cheeks, antennae, and legs light red or even yellowish. The last funicular joint, femora, and tibiae are often darker, except at the articulations. In some specimens the femora are blackish, with the knees, tibiae and tarsi reddish yellow.

Female. Length 8–10.5 mm.

Resembling the worker in color and pubescence, except that the body is darker and less silvery. Differing from the female of all the preceding forms of *fusca* in having the wings colorless or very faintly tinged with yellow near the anterior border, veins yellow, stigma brown.

Male. Length 9–10 mm.

Differing from the male of the preceding forms in having colorless wings and in the color of the body. The head and thorax are black or dark brown, the gaster sometimes paler. Legs, genitalia, antennae, and mandibles clear yellow.

Type locality.— Illinois: Rockford, (Wheeler).

Illinois: Algonquin (W. A. Nason); Galesburg (Centr. Exp. Farms Coll.).

Washington: Yakima River (S. Henshaw).

Oregon: Corvallis, The Dallas (Amer. Mus. Nat. Hist. Coll.).

California: Palo Alto (H. Heath); Corte Madera Creek (W. M. Mann); Harris, Humboldt Co. (J. C. Bradley).

Arizona: Coconino Forest, Grand Canyon, 7,000 ft., Williams, 7,000 ft. (Wheeler); Miller Canyon, Huachuca Mountains (H. A. Wenzel).

New Mexico: Gallinas Canyon, Pecos (T. D. A. Cockerell); Manzanares (Miss Mary Cooper); Las Vegas (Wheeler).

Montana: Helena (W. M. Mann).

Colorado: Colorado Springs, Colorado City, Florissant, Buena Vista, Salida, Pike's Peak, 10,000–11,000 ft. (Wheeler); Troublesome, Boulder (S. A. Rohwer); Salina (T. D. A. Cockerell).

South Dakota: Pierre (S. S. Visher).

Utah: East Mill Creek, Willow Canyon (R. V. Chamberlin).

Kansas: Lawrence.

Michigan: Porcupine Mountains (O. McCreary); Isle Royale (Gleason); Marquette (M. Downing).

New Hampshire: Durham, White Mountains (W. F. Fiske).

Massachusetts: Ellisville, Annisquam (Wheeler); Cotuit, Woods Hole (Miss A. M. Fielde).

British Columbia: Loon Lake, Spillimacheen River, Selkirk Mountains (J. C. Bradley).

This variety, which in its pure form is readily distinguished by the beautiful silvery pubescence and pale legs and antennae of the worker

and the clear wings of the male and female, is very widely distributed. It evidently belongs to the colder portions of the transition zone and is common in the mountains of the western part of the country between elevations of 7,000 and 11,000 ft., but more sporadic in the Eastern States. It nests in the sand dunes and along the beaches of the New England coast but seems to be rather local.

86. F. FUSCA FUSCA var. MARCIDA, var. nov.

WORKER. Length 2.5–4.5 mm.

Closely allied to the typical *fusca* but averaging smaller. The sculpture and pubescence are much as in *fusca*. Body subopaque. Hairs very sparse and short. Body dark reddish brown, head and gaster blackish, sutures of thorax reddish or yellowish, mandibles, antennae, and legs pale yellowish brown, tips of funiculi and middle portions of femora somewhat darker.

FEMALE (DEÄLATED). Length 7–8 mm.

Like the female of the typical *fusca* but smaller; gaster and upper surface of thorax nearly as smooth and shining, with sparse pubescence. Body blackish brown, mandibles, legs, scapes, and bases of funiculi brownish yellow.

TYPE LOCALITY.— British Columbia: Prairie Hills, Selkirk Mountains (J. C. Bradley).

British Columbia: Howser, Golden, Carbonate, 2,600 ft. and Moraine Lake (J. C. Bradley); Golden (W. Wenman).

Alberta: Banff (N. B. Sanson).

Manitoba: Aweme (Jas. Fletcher).

Washington: Ellensburg, Kiona (W. M. Mann); Brinnon, Hood Canal (J. C. Bradley).

Described from nine deälated females and numerous workers. This variety, at first sight, resembles the European *glebaria*, but it is smaller and the female has a smooth, shining gaster and thoracic dorsum like the female of the typical *fusca*. The workers of some colonies are almost indistinguishable from the typical *fusca*, others are as clearly transitional to the varieties *gelida* and *argentea*.

A note by Mr. Bradley accompanying the specimens from Moraine Lake states that they "were gathered under a stone from which the snow had recently receded. The workers are quick and agile and hide under the stones and in moss. Quite a number of nests were found at about timber-line." These remarks indicate that *marcida* is an alpine variety like *gelida*.

87. F. FUSCA FUSCA var. SUBAENESCENS Emery.

F. fusca var. *subaenescens* Emery, Zool. jahrb. Syst., 1893, **7**, p. 659, ☿ ♀; Forel, Ann. Soc. ent. Belg., 1904, **48**, p. 153, ☿ ; Wheeler, Ants, 1910, p. 570.
?*F. fusca* var. *densiventris* Viereck, Trans. Amer. ent. soc., 1903, **29**, p. 73, ☿ .

WORKER. Length: 4–7 mm.

Very closely related to the typical *fusca* but differing in having the body, and especially the gaster more shining. The gaster is finely shagreened and also finely punctate. The pubescence is much sparser than in *subsericea* and usually somewhat sparser than in the typical *fusca*, so that the surface is clearly visible. The hairs and pubescence are yellowish. Body black, with distinct bronzy reflections. Mandibles, antennae, and legs dark brown or dark red; tibiae and femora, except at the articulations, often darker.

FEMALE. Length 8–10 mm.

Resembling the worker in color, sculpture, and pilosity, but the gaster, posterior part of head and mesonotum even smoother and more shining. Wings rather deeply and uniformly infuscated, but slightly less than in the var. *subsericea*. Veins and stigma brown.

MALE. Length 8–10 mm.

Closely resembling the male of the typical *fusca*, but the wings somewhat more deeply infuscated and the gaster more shining and more sparsely and delicately pubescent. Head and thorax black, gaster dark brown; mandibles, legs, genitalia, and scapes clear yellow; funiculi light brown.

TYPE LOCALITY.— South Dakota: (Th. Pergande).

Utah: Little Willow Canyon (R. V. Chamberlin).

Colorado: Manitou, 7,000–8,000 ft., Colorado City and Pike's Peak, 10,000–11,000 ft. (Wheeler); Pike's Peak, printing office, 10,000 feet, Ward, 9,000 ft. (T. D. A. Cockerell).

New Mexico: Old Pecos Pueblo, Pecos, Top of Las Vegas Range, 11,000 ft. (T. D. A. Cockerell); Barela Mesa (Miss Anna Gohrman); Manzanares (Miss Mary Cooper); Harvey's Ranch, Las Vegas Range, 9,600 ft. (Miss Ruth Reynolds); Cloudcroft (H. Skinner).

Montana: Nigger Hill, Powell County (W. M. Mann).

California: King's River Canyon, 8,000 ft. (H. Heath); Alta Peak, Sequoia National Park, 9,500–11,000 ft. (J. C. Bradley).

Washington: San Juan Island (W. M. Mann); Brinnon, Hoods Canal (J. C. Bradley).

Idaho: Troy (W. M. Mann).

Maine: Lower Goose Island, Casco Bay (Wheeler).

New Hampshire: Mt. Washington (C. S. Bacon); Franconia (Mrs. A. T. Slosson).

Massachusetts: Wellesley (A. P. Morse); Blue Hills (Wheeler).
Connecticut: Colebrook (Wheeler).
New York: Ithaca (J. C. Bradley); Bedford (Wheeler).
Ontario: Guelph, Port Stanley (W. H. Wright).
Quebec: Kingsmere (Wheeler).
British Columbia: Howser, Carbonate, Selkirk Mts. (J. C. Bradley); Mt. Goodsir, 7,000 ft. (E. Whymper).
Alberta: Vermillion Pass, 5,000–6,500 ft. (E. Whymper).

This form differs considerably in the amount of pubescence on the gaster. The specimens from New Mexico, especially, have the pubescence nearly as dense and abundant as in *subsericea*, but as the ground surface is coppery and partially visible I have included them in this variety. They are, perhaps, the form described by Viereck as var. *densiventris*, but his original description based on two workers from Beulah, New Mexico (8,000 feet), is far from clear, and I have not been able to examine the types. Specimens from Rockford, Ill., agree very closely with Emery's description based on material from South Dakota and Connecticut. The worker specimens from Alta Peak, Calif., are very small and the pubescence is very delicate. They are decidedly bronzy, but in other respects might be referred to the typical *fusca*.

F. subaenescens nests under stones in cold, shady woods. Like the var. *argentea* it is rare and sporadic at lower altitudes and latitudes in the transitional zone and is evidently a boreal form, slightly more eurythermal than the true *fusca*.

88. F. FUSCA FUSCA var. GELIDA, var. nov.

F. fusca var. *neorufibarbis* Forel, Ann. Soc. ent. Belg., 1904, **48**, p. 153, ♀ ♀; Pergande, Proc. Wash. acad. sci., 1900, **2**, p. 519; Wheeler, Bull. Amer. mus. nat. hist., 1906, **22**, p. 344; Ants, 1910, p. 570.

WORKER. Length 2.5–5 mm.

Head and thorax subopaque, frontal area and gaster shining and rather smooth. Hairs as in the typical *fusca*, pale yellow; pubescence much sparser, not only on the gaster but also on the head and thorax, so that the ground surface of the body is fully revealed. This is rather densely and sharply shagreened on the head and thorax, but very finely shagreened and sparsely punctate on the gaster.

Reddish brown, posterior half of head above black, sometimes with a bronzy reflection. Gaster often as dark as the top of the head. Thorax more or less infuscated. In large workers the infuscation is

often confined to a spot on the pronotum and one on the mesonotum; medium sized workers often have the pleurae more or less infuscated and in the smallest workers the whole thorax may be dark brown. Base of gaster and venter usually paler than the upper surface. Petiole more compressed anteroposteriorly, with flatter anterior and posterior surfaces and sharper border than in any of the preceding forms of *fusca*.

Female. Length 6–8 mm.

Resembling the worker, but the gaster even more shining. This region is also more spherical and less elliptical than in the other forms of *fusca*. The head and thorax are subopaque, except the frontal area, which is shining. Posterior border of the pronotum and the disc of the mesonotum with a few large, scattered punctures.

Reddish brown, posterior portion of head, upper surface of gaster, posterior border of pronotum, the mesonotum, scutellum, and metanotum blackish or dark brown. The pleurae may also be clouded with this color. Petiole and legs more yellowish brown. In some specimens (from California) the thorax is pure reddish brown, with three large spots on the mesonotum, the metanotum and posterior portion of the scutellum black. Wings colorless, with pale brown veins and darker stigma.

Male. Length 6–7 mm.

Head and thorax, including the frontal area, opaque; mesonotum covered with coarse, scattered punctures. Epinotum, petiole, and gaster shining. Erect hairs on thoracic dorsum, petiole, and base of gaster rather abundant. Pubescence very sparse and rather long. Black; gaster dark brown; genital appendages distinctly infuscated. Legs yellow, middle portions of femora slightly infuscated. Antennae black; only the tips of the mandibles brownish. Wings as in the female.

Type locality.— Colorado: Ward, 9,000 ft. (T. D. A. Cockerell).

Colorado: Arapahoe Peak, timberline, Long's Peak, 12,500 ft. (T. D. A. Cockerell); Cripple Creek, 10,200 ft., Cheyenne Mountain, 8,000 ft. (Wheeler); Canyon City (P. J. Schmitt).

New Mexico: N. E. Truches Peak, 12,000–13,000 ft., above timberline (Mrs. W. P. Cockerell and Miss Ada Springer); Harvey's Ranch, Las Vegas Range, 9,600 ft. (Miss Ruth Reynolds); Top of Las Vegas Range, 11,000 ft. (T. D. A. Cockerell).

Arizona: Coconino Forest, Grand Canyon, 7,000 ft. (Wheeler).

California: Alta Peak, Sequoia National Park, 9,500–11,000 ft., Blue Lake, Humboldt Co. (J. C. Bradley).

Oregon: (Amer. Mus. Nat. Hist. Coll.).

Washington: Three Brothers, Olympic Range (J. C. Bradley).

Michigan: Porcupine Mountains, Isle Royale (O. McCreary).

New Hampshire: Mt. Washington, 3,840 ft. (W. Reiff); Lafayette, 4,000 ft., Sphagnum bog (J. H. Emerton).

Alaska: Kassiloff Lake, Kenai Peninsula (Berlin Mus.); Sitka, Metlakaktla, Kadiak (Th. Pergande); Homer (A. Mehner).

British Columbia: Vancouver (A. L. Melander); Lake Louise, Heeto, Prairie Hills, Selkirk Mountains, above timberline, Fielde, Roger's Pass (J. C. Bradley).

Alberta: Laggan, Banff (J. C. Bradley); Emerald Summit Lake, Vermillion Pass, Vermillion Valley, 6,100 ft., Yoho Valley 4,600 ft., Ice River Valley 5,000 ft. (E. Whymper).

Saskatchewan: Methy Lake (R. Kennicott).

Ontario: Rat Portage (J. C. Bradley).

Quebec: Saguenay River (Geo. Engelhardt); Anticosti Island (S. Henshaw); East Maine River (A. Skinner); Mingan Island, Niapisca Island (S. Henshaw).

Labrador: Square Island (A. S. Packard); St. Lewis Inlet.

Newfoundland: Bay of Islands (L. P. Gratacap); Spruce Brook, Port Saunders, Port au Croix (Amer. Mus. Nat. Hist. Coll.).

Nova Scotia: Digby (J. Russell).

This variety has been confounded by Forel, Pergande, and myself, and possibly also by Emery, with the true *neorufibarbis* described below. It is, however, a perfectly distinct form, which, notwithstanding its wide distribution as shown by the preceding list of localities, is the most stenothermal and alpine of all our American forms of *fusca*. It is closely related to *subaenescens* in sculpture and pubescence but is characterized by the deep red color of the thorax and the constant infuscation of the pro- and mesonotum even in large specimens. I have found it nesting in rather small colonies under stones or in logs in woods or shady canyons at high altitudes, just below timberline.

89. F. FUSCA FUSCA var. NEORUFIBARBIS Emery.

F. fusca var. *neorufibarbis* Emery, Zool. jahrb. Syst., 1894, **7**, p. 660, ☿ .

WORKER. Length 3–6 mm.

Like the variety *gelida* in sculpture. Frontal area shining. Head and thorax subopaque, gaster shining, transversely shagreened. Hairs yellow, very short and sparse, absent on the thorax. Pubescence finer and a little denser on the gaster than in *neorufibarbis* but not concealing the shining surface. Head black, cheeks, front, cly-

peus, and mandibles dark brown. Thorax, petiole, legs, scapes, and base of funiculi clear yellowish red, the legs a little paler; only in small workers is there a slight tendency to infuscation of the thoracic dorsum. Gaster black or dark reddish brown, venter and base of first segment often paler. Petiole as in *neorufibarbis*.

Female (deälated). Length 7 mm.

Very closely resembling the female of *gelida*, especially the form with pale thorax, having the mesonotum ornamented with three large dark brown or black blotches, but the pubescence, especially on the gaster, is finer and denser. Frontal area shining.

Type locality.— South Dakota: Hill City (Th. Pergande).

South Dakota: Harding County (S. S. Visher).

Utah: Willow Canyon, Salt Lake County, (R. V. Chamberlin).

Montana: Helena, Elkhorn, Nigger Hill, Powell County (W. M. Mann).

Idaho: Moscow (J. M. Aldrich).

Oregon: Portland (Amer. Mus. Nat. Hist. Coll.).

Washington: San Juan Island (W. M. Mann); North Bend (T. Kincaid); Union City (J. C. Bradley).

British Columbia: Alert Bay, Vancouver Island (H. I. Smith); Chillimack Valley (J. M. MaCoun); Carbonate, Fielde (J. C. Bradley).

Alberta: Lake Minnewonka (J. C. Bradley).

This variety, of which I have seen many workers, but only one female, is very closely related to the var. *gelida* though evidently occurring at much lower altitudes. Superficially it resembles the European *F. rufibarbis* but can be at once distinguished by its shining and much less pubescent gaster, smooth frontal area, and much sparser pilosity.

I believe that I am right in limiting Emery's name *neorufibarbis* to this form, first, because he describes the color as like that of the European *rufibarbis* and second, because he cites South Dakota and Nebraska among the list of localities. The form I have called *gelida* cannot occur in these states. Third, I possess two workers from South Dakota sent me several years ago by Pergande under the name "*neorufibarbis*." These evidently belonged to the cotype series. If Emery actually included both forms under the latter name, it should be applied to the specimens from South Dakota, the first locality mentioned, and not to the specimens from Colorado, Montana, and California, which in part at least were probably referable to *gelida*.

90. F. FUSCA FUSCA var. NEOCLARA Emery.

F. fusca var. *neoclara* Emery, Zool. jahrb. Syst., 1894, **7**, p. 661, ♀ ; Wheeler, Ants, 1910, p. 570.
F. cinereorufibarbis Marsh, Bull. 64, Bur. ent. U. S. dept. agric. pt. 9, p. 73.

WORKER. Length 3–6 mm.

Epinotum rather rounded, not angular in profile. Petiole with a small notch in the transverse superior border; seen from behind cordate. Body opaque, shagreened; gaster only slightly lustrous; frontal area not smooth or shining. Hairs yellow, very short, sparse. Pubescence dense and rather long, especially on the head and gaster, where it conceals the surface. Body and appendages pale red; mandibles darker; vertex, tips of antennae, funiculi, and upper surface of gaster infuscated.

FEMALE. Length 7–8 mm.

Resembling the worker in color, sculpture, and pubescence. The ocellar triangle, the gaster behind the first segment, the tips of the funiculi, the scutellum, and metanotum, more or less infuscated. Remainder of body and appendages pale yellowish red. In some specimens there are three elongate brown blotches on the mesonotum, and the posterodorsal portion of the head is infuscated. Pubescence, especially on the gaster, much longer than in the worker so that this region has a bright pruinose appearance. Wings colorless, with brown veins and stigma.

MALE. Length 7–8 mm.

In form resembling the male of the typical *fusca*. Mandibles narrow, edentate. Thorax robust, gaster slender. Petiole thick, low, transverse, with very blunt, feebly excised border. Opaque; gaster more shining. Pubescence grayish, long and dense. Black; gaster dark brown, mesonotum sometimes with a pair of yellow spots. Antennae dark brown. Genital appendages distinctly infuscated. Legs pale yellow. Wings as in the female.

TYPE LOCALITY.— Colorado.

Colorado: Boulder, Canyon City, Longmont (P. J. Schmitt); Colorado Springs, Colorado City, Salida, Denver (Wheeler); South Boulder, Salina, Modern (T. D. A. Cockerell); Greeley (J. M. Aldrich); Rocky Ford (H. O. Marsh).

New Mexico: Pecos and Las Vegas, 6,400 ft. (T. D. A. Cockerell).

This beautiful and easily recognized variety occurs in Colorado only at altitudes below 7,000 feet, usually nesting in the sandy soil of river valleys. It is conspicuously common in the streets and parks of Colorado Springs, where it makes flat mounds consisting of numerous

small, more or less confluent craters not unlike the nests of *F. subsericea* in grassy places in the Eastern States, or of *F. cinerea* in sandy river valleys of Southern Europe. It is readily enslaved by the forms of *sanguinea* inhabiting the same region. The males and winged females mature during the latter half of July.

Mr. Geo. B. King has recorded the variety *neoclara* from Essex County, Mass., and I possess eight specimens bearing labels with this locality. They resemble Colorado specimens very closely, except that the petiole is not emarginate and therefore not cordate when seen from behind, and the gaster is not infuscated. These specimens may represent a distinct variety. If they are really specimens of *neoclara*, I am unable to account for their occurrence in Massachusetts unless they were accidentally introduced from the West. Of course, the locality labels may be erroneous.

91. F. FUSCA FUSCA var. BLANDA, var. nov.

WORKER. Length 3–3.5 mm.

Resembling *neoclara*, but smaller, with the whole body reddish brown, the legs, antennae, and mandibles paler, the head, gaster, and tips of funiculi not infuscated. Subopaque and very densely and finely punctate or shagreened, the head and gaster slightly shining. Frontal area opaque. Hairs and pubescence white, the former short and very sparse, absent on the thorax, the latter very fine and short, rather dense on the gaster, shorter on the head and thorax. Thorax with very feeble mesoëpinotal constriction, epinotum rather long, obtusely angular in profile, its base longer than the declivity which is very sloping. Petiole rather thick and blunt, with entire and rounded superior border.

Described from a dozen workers taken by Prof. Trevor Kincaid at Olympia, Washington (type locality), six workers taken by the same collector at Seattle, Wash., two workers taken by Mr. J. C. Bradley in the Yosemite Valley and four workers taken by the same collector at Lemon Cove, Tulare County, California. The status of this variety is somewhat problematical. It may be merely a very pale form of the var. *marcida*, although there is little variation in the series of workers examined. They differ from the worker *neoclara* in the uniform brown color of the body, the shorter and more delicate pubescence, the absence of a notch in the petiolar border, the narrower head and smaller size.

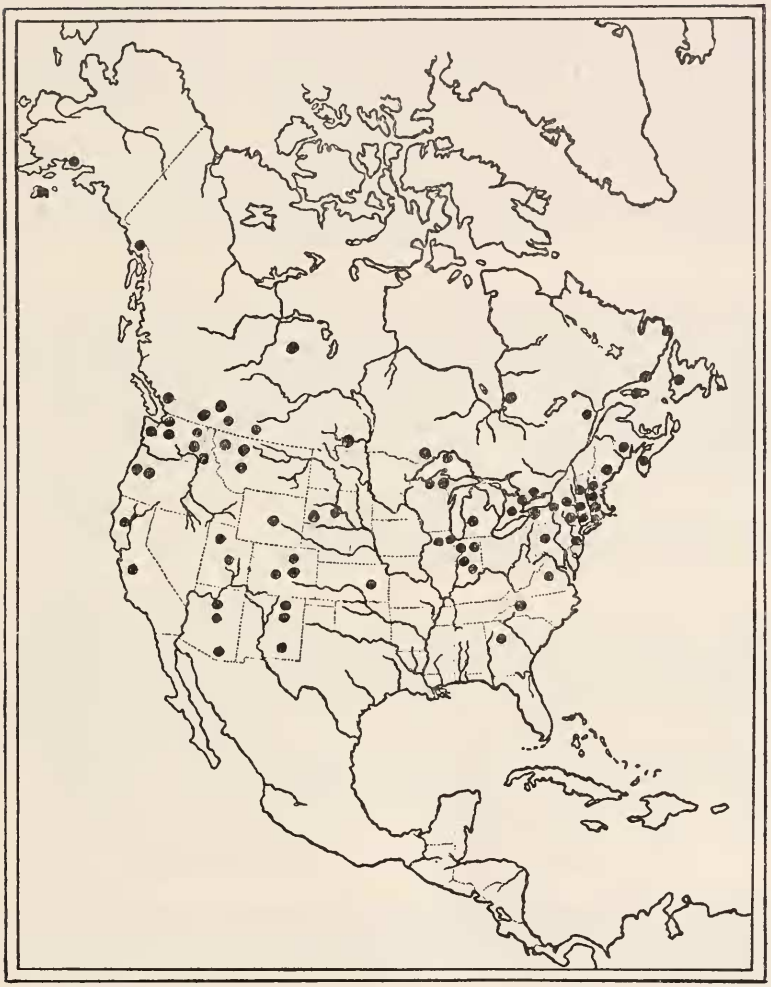

Fig. 6.— Distribution of the Nearctic forms of *Formica fusca*.

92. F. FUSCA PICEA Nylander.

F. picea Nylander, Acta Soc. Fennica, 1846, **2**, p. 917, 1059, ☿ ♀; Förster, Hymen. stud., 1850, **1**, p. 30, ☿.
F. gagates Meinert, Naturv. abh. Dansk. vid. selsk., 1860, ser. 5, **5**, p. 316, ☿ (*nec* ♀ ♂); Ruzsky, Formicar. Imper. Ross., 1905, p. 378; Dalla Torre, Catalog. Hymen., 1893, **7**, p. 198.
F. glabra White, Ants and their ways, 1883, p. 253.
F. transkaukasica Nassonov, Arb. Lab. zool. Univ. Moskau, 1889, **4**, p. 21.
F. fusca transkaukasica Ruzsky, Formicar. Imper. Ross., 1905, p. 384, ☿.
F. fusca gagates var. *filchneri* Forel, Ann. Soc. ent. Belg., 1907, **51**, p. 208, ☿.
F. fusca picea Emery, Deutsch. ent. zeitschr., 1909, p. 195, fig. 8, ☿.

WORKER. Length 3–6.5 mm.

About the size of the typical *fusca*. Epinotum angular in profile. Petiole rather broad, compressed anteroposteriorly, with sharp, entire border. Surface of body, including the frontal area, smooth and shining. Mandibles more opaque, finely striated and coarsely punctate. Hairs and pubescence very sparse. Color jet black; mandibles, antennae and legs dark red or dark brown; femora, tibiae, and ends of funiculi often darker.

FEMALE and MALE, judging from the descriptions, very similar to the corresponding phases of the typical *fusca*, but with the body of the female smooth and shining as in the worker.

Northern Europe and Asia to Eastern Siberia. According to Emery, this form represents the true *gagates* in Sweden, Finland, Russia, Eastern Siberia, and China, and has frequently been confounded with that species. He calls attention to the fact that oriental specimens sometimes have a few erect hairs on the underside of the head. I find these hairs in one of two workers of *picea* from Lahoul, Thibet, given me by Professor Forel.

93. F. FUSCA PICEA var. GAGATOIDES Ruzsky.

F. fusca var. *gagatoides* Ruzsky, Nachr. Russ. geogr. gesell., 1904, p. 289, ☿ ♀; Formicar. Imper. Ross., 1905, p. 377.
F. fusca picea var. *gagatoides* Emery, Deutsch. ent. zeitschr., 1909, p. 195, ☿ ♀.

WORKER and FEMALE.

Intermediate in its characters between *picea* and *fusca*.

Northern Europe.

94. F. GAGATES Latreille.

F. gagates Latreille, Essai hist. fourmis France, 1798, p. 36, ☿ ♀; Hist. nat. fourmis, 1802, p. 138, pl. 5, fig. 26, ☿ ♀; Lepeletier, Hist. nat. insect. Hymén., 1836, **1**, p. 200, ☿ ♀; Mayr, Verh. Zool. bot. ver. Wien, 1855, **5**, p. 347, ☿ ♀ ♂; Europ. Formicid., 1861, p. 46, ☿ ♀ ♂; Ern. André, Spec. Hymén. Europ., 1882, **2**, pt. 14, p. 182, 189, ☿ ♀ ♂; Dalla Torre, Catalog. Hymen., 1893, **7**, p. 198.

F. fusca st. *gagates* Forel, Denks. Schweiz. gesell. Naturw., 1874, **26**, p. 53, 217, ☿ ♀ ♂.

F. fusca gagates var. *muralewiczi* Ruzsky, Formicar. Imper Ross., 1905, p. 384.

F. fusca subsp. *gagates* Emery, Deutsch. ent. zeitschr., 1909, p. 194, fig. 7, ☿ ♀ ♂.

WORKER. Length 5–7.5 mm.

Closely related to *F. fusca*. Large and robust. Epinotum in profile rounded, without an angle between the base and declivity. Petiole broad, much compressed anteroposteriorly, with thin, sharp border.

Nearly the whole body smooth and shining, usually also the frontal area. Gaster very shining, very finely and transversely shagreened.

Hairs whitish, coarse, rather abundant on the gaster but very sparse elsewhere. Pubescence short and sparse, not concealing the shining surface.

Body deep black, mandibles dark brown, antennae, except their tips and legs, dark red or brown, with middle portion of the femora and tibiae sometimes black.

FEMALE. Length 9–11 mm.

Body robust. Head and thorax slightly, gaster more shining; Mesonotum with a few scattered foveolae. Pubescence on gaster very sparse. Color like that of the worker. Wings usually deeply and uniformly infuscated.

MALE. Length 9–10 mm.

Closely resembling the male of the typical *fusca* in color and sculpture but the pubescence longer and more abundant so that the body has a silky luster. Hairs almost absent, except on the venter. Petiole thick, with very blunt, entire or nearly entire superior border.

This form, which I would regard as an independent species and not as a subspecies of *fusca*, is confined to Asia Minor and Southern Europe (Southern France, Italy, Southern Germany, Austro-Hungary, the Balkan Peninsula, and the Crimea). According to Emery, Mayr detected transitions between this form and *F. fusca picea* in material from the Caucasus. Forel, who has studied the habits of *gagates* in Austria and Canton Ticino, Switzerland, found it nesting in oak forests under large stones and roots. The galleries are large and deep.

It attends aphids on the oaks. Mayr has also noticed the association of *gagates* with these trees, a relation similar to that obtaining between the oaks and the species of Liometopum and the varieties and subspecies of *Camponotus fallax* in both hemispheres.

95. F. GAGATES var. FUSCO-GAGATES Forel.

?F. gagates var. *morio* Latreille, Essai hist. fourmis France, 1798, p. 36, ☿ ; Hist. nat. fourmis, 1802, p. 140.

F. fusco-gagates Forel, Denks. Schweiz. gesell. naturw., 1874, **26**, p. 54, ☿ .

F. gagates var. *fusco-gagates* Dalla Torre, Catalog. Hymen., 1893, **7**, p. 199.

F. fusca gagates var. *fusco-gagates* Forel, Ann. Mus. St. Petersbourg, 1904, **8**, p. 384; Emery, Deutsch. ent. zeitschr., 1909, p. 195, ☿ .

WORKER.

Intermediate between *fusca* and *gagates*, but smaller, the structure of the epinotum subangular in profile and therefore more as in *fusca*. Head, thorax, and frontal area more opaque than in *gagates*.

Italian Switzerland.

Emery believes that this form may be a hybrid.

96. F. RUFIBARBIS Fabricius.

F. rufa Fourcrois, Ent. Paris, 1758, **2**, p. 452 (*nec.* Linné).

F. pratensis Olivier, Encycl. meth. insect., 1791, **6** (*nec.* Retzius).

F. rufibarbis Fabricius, Ent. syst., 1793, **2**, p. 355, ☿ ; Syst. Piez., 1804, p. 402; Jurine, Nouv. meth. class. Hymén., 1807, p. 273, ☿ ♀ ♂; Ern. André, Rev. mag. zool., 1874, ser. 3, **2**, p. 185; Spec. Hymén. Europ., 1822, **2**, p. 182, 186, 189, pl. 2, fig. 7, ☿ ♀ ♂; Mayr, Fedtschenko's Turkestan. Formicid., 1877, p. 7; Lubbock, Ants, bees, wasps, ed. 5, 1882, p. 80; Forel, Bull. Soc. Vaud. sci. nat., 1884, ser. 2, **20**, p. 379; Dalla Torre, Catalog. Hymen., 1893, **7**, p. 209; Ruzsky, Formicar. Imper. Ross., 1905, p. 385, ☿ ♀ ♂.

F. cunicularia Latreille, Essai hist. fourmis France, 1798, p. 38, ☿ ♀ ♂; p. 40, ☿ ♀ ♂; Brullé, Exped. sci. Morée zool., 1832, **2**, p. 326; Lepeletier, Hist. nat. insect. Hyméu., 1836, **1**, p. 203; Nylander, Acta Soc. Fennica, 1846, **2**, p. 913, 1059, pl. 18, fig. 17–19, ☿ ♀ ♂; Förster, Hymen. stud., 1850, **1**, p. 25, ☿ ♀ ♂; F. Smith, Trans. Ent. soc. Lond., 1855, ser. 2, **3**, p. 103, pl. 9, fig. 14, ☿ ♀ ♂; Mayr, Verh. Zool. bot. ver. Wien, 1855, **5**, p. 342, ☿ ♀ ♂; Europ. Formicid., 1861, p. 47.

F. fusca st. *rufibarbis* Forel, Denks. Schweiz. gesell. naturw., 1874, **26**, p. 53, ☿ ♀ ♂.

F. fusca subsp. *rufibarbis* Emery, Deutsch. ent. zeitschr., 1909, p. 197; Karawajew, Rev. Russ. ent., 1909, p. 269.

Worker. Length 4–7.5 mm.

Very closely related to *F. fusca* and scarcely differing in structural characters. The epinotum is distinctly angular in profile; the petiole rather broad, compressed anteroposteriorly, with broadly rounded, entire, rather sharp superior border. Legs and antennae long.

Head, thorax, and gaster, including the frontal area, opaque, densely shagreened, venter and legs feebly shining.

Hairs yellow, very sparse, present on the upper surface of the head, pronotum and gaster, and sometimes also on the petiole and other parts of the thorax. Pubescence dense and rather long, concealing the surface, but without a silky gloss.

Pale red, posterodorsal portion of head and the gaster blackish brown. Mandibles dark red; funiculi, except at the base, the coxae and sometimes also the middle portions of the femora, infuscated. Rarely in large workers the pro- and mesonotum are slightly infuscated. In small workers the infuscation of the thorax may be more extensive.

Female. Length 9–11 mm.

Resembling the worker in sculpture, pubescence, and color, but the posterior margin of the pronotum, the scutellum, metanotum, more or less of the pleural region, and three elongate blotches on the mesonotum, dark brown. The venter is usually reddish. Wings grayish hyaline, with pale brown veins and darker stigma. Hairs longer and more abundant than in the worker, especially on the thoracic dorsum.

Male. Length 9–10 mm.

Very similar to the male of *fusca* and its varieties, but the thorax and gaster are more robust. Mandibles pointed, edentate. Petiole though thick and low, with a sharp, compressed and very broadly and distinctly excised border.

Body opaque, gaster scarcely shining. Frontal area opaque.

Hairs very sparse, present on the head, thoracic dorsum, and venter, but absent elsewhere. Pubescence grayish, short and dense.

Black; legs and genitalia yellow; tarsi of the former and tips of appendages of the latter infuscated; tips of mandibles brown. Wings uniformly gray as in the female.

Widely distributed through Europe and Northern Asia and occurring in Sardinia though absent from the smaller Mediterranean Islands. It is a distinctly xerothermal form and in the Alps does not reach such an elevation as the typical *fusca*. According to Ruzsky, however, it occurs at an altitude of 3,000 m. in the Caucasus, and according to Forel even higher in the Himalayas.

Although this ant is so very close to *fusca* in its morphological structure, I have nevertheless followed the majority of authors in regarding it as a species and not as a subspecies of *fusca*. P. Huber and Forel

long ago showed that its habits and disposition are peculiar. It nests under stones or in open ground without building craters or mounds and in disposition is quite unlike the *fusca* forms, being very agile, fierce, and aggressive. It also has a peculiar odor quite unlike that of *fusca*, and this, together with the pugnacious disposition, also characterizes the American varieties.

97. F. RUFIBARBIS var. GLAUCA Ruzsky.

F. rufibarbis var. *glauca* Ruzsky, Arb. Ges. naturf. Kasan, 1895, **28**, p. 20, ♀ ; Berlin. ent. zeitschr., 1896, **41**, p. 70; Forel, Ann. Mus. St. Petersbourg, 1904, **8**, p. 385; Ruzsky, Formicar. Imper. Ross. 1905, p. 396.

F. fusca rufibarbis var. *glauca* Emery, Deutsch. ent. zeitschr., 1909, p. 198, ♀ .

WORKER. Differing from the typical form in having the pubescence denser and with a bluish, silky luster on the gaster. The color and pilosity are like those of the typical form.

Southern Russia and Western Siberia.

98. F. RUFIBARBIS var. SUBPILOSA Ruzsky.

F. rubibarbis var. *subpilosa* Ruzsky, Ants envir. Aral Sea (Russian), 1902, p. 9, ♀ ; Zool. jahrb. Syst., 1902, **17**, p. 472; Forel, Ann. Mus. St. Petersbourg, 1904, **8**, p. 18; Ruzsky, Formicar. Imper. Ross., 1905, p. 397; Karawajew, Hor. Soc. ent. Ross., 1909, **39**, p. 16.

F. fusca rufibarbis var. *subpilosa* Emery, Deutsch. ent. zeitschr., 1909, p. 198, ♀ .

WORKER. Color as in pale specimens of the typical *rufibarbis*. Pubescence whitish, dense on the gaster, which therefore has a gray tinge. Hairs also whitish, short, covering the whole body, but absent on the gula. Petiole moderately thick, with rather sharp superior border.

Central Europe, Southern Russia, and Central Asia to Western China.

This form resembles *F. cinerea* var. *imitans* but can be distinguished by the absence of erect hairs on the gula. The color, according to Ruzsky, is very variable, specimens from the Aral Sea region being very pale, like the var. *clara*, whereas those from Central Europe, the Crimea, Southeastern Russia, and the Caucasus are darker and more like the typical *rufibarbis*.

99. F. RUFIBARBIS var. CLARA Forel.

F. rufibarbis var. *clara* Forel, Ann. Soc. ent. Belg., 1886, **30**, p. 206, ♀ ; Ann. Mus. St. Petersbourg, 1904, **8**, p. 384.

F. rufibarbis clara Ruzsky, Zool. jahrb. Syst., 1902, **17**, p. 471, ☿ ♀ ♂; Formicar. Imper. Ross., 1905, p. 399.

F. fusca rufibarbis var. *clara* Emery, Deutsch. ent. zeitschr., 1909, p. 198, ☿ ♀ ♂.

Worker. Length 5–5.6 mm.

Head, thorax, petiole, legs, and scapes pale ferruginous red; gaster dark brown; mandibles reddish brown. Some specimens have the tips of the scapes brownish and a spot of the same color on the vertex and occiput. Erect hairs lacking or very sparse; pubescence delicate and not very dense.

Female. Length 8–9.5 mm.

Of the same color as very pale forms of the typical *rufibarbis* or even paler. Pubescence dense, sericeous on the body. Erect hairs sparse.

Male. Length 8.5–9 mm.

Head dark brown, thorax and gaster brownish yellow. Mesonotum with three dark brown blotches and with the scutellum, part of the epinotum, petiolar border and spots on the pleurae of the same color. Legs, mandibles, and scapes yellowish brown; funiculi brown; wings infuscated.

Southern Russia, Siberia, Central Asia, Caucasus, Syria.

100. F. rufibarbis var. caucasica Ruzsky.

F. rufibarbis clara var. *caucasica* Ruzsky, Formicar. Imper. Ross., 1905, p. 401, ☿.

F. fusca rufibarbis var. *caucasica* Emery, Deutsch. ent. zeitschr., 1909, p. 198, ☿.

Worker. Color as in the var. *clara* or only slightly darker, red or brownish red. Erect hairs lacking, with sparse, appressed hairs only on the sides of the head and thorax and on the legs and clypeus. Sculpture of body more delicate than in the var. *clara*, the whole body being subopaque, with feeble luster. Frontal area smooth and shining.

Caucasus Mountains.

101. F. rufibarbis var. occidua Wheeler.

F. rufibarbis Wheeler, Amer. nat., 1902, **36**, p. 947 *et seq*, ☿.

F. rufibarbis var. *occidentalis* Wheeler, Ants, 1910, p. 570.

F. rufibarbis var. *occidua*, nom. nov. Wheeler, Psyche, 1912, **19**, p. 90.

Worker. Length 4–7.5 mm.

Differing from the typical form of Europe only in pilosity. The thorax is either entirely without erect hairs or has only a few on the

pronotum. The pubescence on the gaster is usually somewhat denser and more silvery so that it has a grayish or glaucous tinge, somewhat as in the var. *glauca*.

Female. Length 10–11 mm.

Indistinguishable from paler colored females of the typical form. Hairs, especially on the thorax, much more abundant than in the worker.

Type locality.— California: Palo Alto, (H. Heath and W. M. Mann).

California: Pasadena, San Ysidro near Santa Barbara, Palmer's Canyon, San Gabriel Mountains (Wheeler); Mount Wilson, Three Rivers, Sissons, Berkeley, Wild Cat Canyon near San Pablo, Lemon Cove, Tulare County (J. C. Bradley); Los Angeles (F. Grinnell, Jr.); San José (H. Heath); Santa Cruz Island (R. V. Chamberlin).

Washington: Wawawai (W. M. Mann).

The specimens from Washington have somewhat smoother bodies, the hairs are completely absent on the thorax in all specimens and this region is spotted with black and the black of the posterior part of the head runs under onto the posterior part of the gula, so that these specimens may, perhaps, represent a distinct variety.

The habits of the Californian form are very similar to those of the European type. It is fierce and aggressive and nests under stones in the open live-oak groves on the warm slopes of the Coast Range, at rather low altitudes.

102. F. rufibarbis var. gnava Buckley.

F. gnava Buckley, Proc. Ent. soc. Phil., 1866, **6**, p. 156, ☿ ♀ ♂; Dalla Torre, Catalog. Hymen., 1893, **7**, p. 199.

F. fusca var. *gnava* Wheeler, Trans. Tex. acad. sci., 1902, **4**, p. 19; Bull. Amer. mus. nat. hist., 1906, **22**, p. 344; Ants, 1910, p. 570.

F. fusca var. *subsericeo-ncorufibarbis* (Emery) Wheeler, Trans. Tex. acad. sci., 1902, **4**, p. 19.

Worker. Length 3.5–6 mm.

Differing from the preceding variety and the typical form in its average smaller size and in the more finely shagreened and therefore more shining surface of the body. Frontal area opaque. The head and gaster, especially, are more shining than in any of the other varieties of *rufibarbis*. This is due in part to the finer and shorter pubescence. The head, thorax, petiole, and legs vary from light to dark brownish red or brown, with the top of the head and often also the pro-

and mesonotum infuscated. Tips of funiculi not infuscated. The gaster is black, not paler ventrally. Small workers often have the head and thorax dark brown. In some large specimens the head is immaculate above. The hairs are sparse and scarcely more abundant on the thorax than in the variety *occidua*.

Female. Length: 7–8 mm.

Smaller than the female of the typical *rufibarbis*. Surface subopaque and gaster somewhat shining as in the worker. Pubescence longer and denser, hairs more abundant. Head, thorax, and petiole brown; mandibles, cheeks, clypeus, antennae, and legs yellow; mesonotum with three large dark brown blotches, often more or less confluent. Gaster blackish brown. Wings colorless, with dark brown veins and stigma.

Male. Length 7–8 mm.

Mandibles edentate or indistinctly tridentate. Thorax and gaster stout. Petiole much as in the typical form but with the notch in its superior border often obsolete or narrow.

Surface of body, including the frontal area, opaque; head and thorax coarsely, gaster more finely shagreened; the gaster slightly lustrous.

Hairs extremely sparse, absent on the upper surface of the thorax and gaster. Pubescence grayish, short but rather abundant.

Head and thorax black; gaster dark brown; genital appendages strongly infuscated. Legs yellow. Wings as in the female.

Type locality.— Texas.

Texas: Austin, Fort Davis, New Braunfels, Langtry (Wheeler); Llano (A. W. Morrill); Kerrville, Devil's River (F. C. Pratt).

New Mexico: Las Vegas (T. D. A. Cockerell); Las Valles (Miss Mary Cooper); Mesa Negra, San Ildefonso (E. L. Hewett and Miss Ruth Reynolds); Albuquerque (Wheeler); Alamogordo (G. v. Krockow).

Arizona: Indian Garden, Grand Canyon, Phoenix, Prescott, Tempe, Tucson, Benson Miller Canyon, Huachuca Mountains (Wheeler); Ramsey Canyon, Huachuca Mountains (W. M. Mann).

California: Needles (Wheeler).

Colorado: Canyon City (P. J. Schmitt); Salida (Wheeler).

Utah: Lehi (W. A. Hooker).

This variety has been confounded with *F. fusca* var. *neorufibarbis* and var. *gelida* by Emery, Forel, and myself, owing to the somewhat shining surface of the gaster, but a study of living colonies shows that it belongs to *rufibarbis*, for the workers have the characteristic odor of this species, are aggressive, and live in the ground under stones or in nests without craters. They are found only in shady canyons at rather low altitudes in the Southwest, never in the open desert

Fig. 7.— Distribution of the Nearctic forms of *Formica rufibarbis*.

country. The colonies which are often rather large, closely resemble those of the variety *occidua* on the Pacific Coast, but the ants, when seen in masses, have a bronzy appearance, as Buckley observed.

103. F. CINEREA CINEREA Mayr.

F. cinerea Mayr, Verh. Zool. bot. ver. Wien, 1853, **2**, p. 280, ☿ ♀; 1bid., 1855, **5**, p. 344, ☿ ♀ ♂; Nylander, Ann. sci. nat. Zool., 1856, ser. 4, **5**, p. 64, ☿ ♀ ♂; Meinert, Natur. abh. Dansk. vid. selsk., 1860, ser. 5, **5**, p. 43, ☿ ♀ ♂; Mayr, Europ. Formicid., 1861, p. 47, 48, ☿ ♀ ♂; Ern. André, Spec. Hymén. Europ. 1882, **2**, pt. 14, p. 181, 186, 189, ☿ ♀ ♂; Lubbock, Ants, bees, wasps, ed. 5, 1882, p. 882, p. 16, etc.; Dalla Torre, Catalog. Hymen. 1893, **7**, p. 193; Ruzsky, Formicar. Imper. Ross., 1905, p. 404.

F. fusca st. *cinerea* Forel, Denkschr. Schweiz. gesell. naturw., 1874, **26**, p. 53, 218, ☿ ♀ ♂; Bruyant, Fourmis France Centr., 1890, p. 56.

F. fusca subsp. *cinerea* Emery, Deutsch. ent. zeitschr., 1909, p. 199, ☿ ♀ ♂.

WORKER. Length 3.5–7 mm.

Very closely related to *F. fusca*. Pro- and mesonotum not very convex, mesoëpinotal constriction rather shallow; epinotum low, with straight base and very sloping declivity, the two surfaces forming a very large and blunt angle with each other. Petiole narrow, with convex anterior and posterior surface and blunt, entire border, which is often produced upward or bluntly pointed in the middle.

Surface of the body opaque, densely shagreened; mandibles somewhat shining, sharply striatopunctate. Frontal area opaque.

Hairs and pubescence white or pale yellow, both very abundant, the hairs short, blunt, and erect or suberect on all parts of the body, except antennal scapes, long on the gula, short and sparser on the legs, and oblique on the flexor surfaces of the tibiae. Pubescence very dense, rather long, uniformly concealing the surface and giving it a silvery appearance.

Dark grayish brown or blackish brown. Mandibles, scapes, legs, and basal halves of funiculi, and in some specimens the middle portions of the femora and tibiae, reddish. In some the reddish tinge also extends to the clypeus, cheeks, petiole, and ventral portion of the thorax.

FEMALE. Length 9–11 mm.

Robust, with large elliptical gaster, superficially resembling the females of *F. fusca* var. *subsericea* and var. *glebaria*. Like the worker in sculpture, pilosity, and color, except that the hairs are longer, more slender and pointed, even on the gaster. The petiole is broad, with flat posterior surface and sharp superior border, often slightly emarginate in the middle. Wings grayish hyaline with pale brown veins and darker stigma.

Male. Length 8–10 mm.

Body slender, as in the typical *fusca*. Mandibles bidentate or edentate. Head shaped like that of the male of *fusca*. Petiole low and thick, with blunt superior border, which is transverse and feebly and broadly excised.

Body, including the frontal area, opaque, gaster slightly glossy.

Hairs grayish, erect, short, abundant, except on the upper surface of the gaster, oblique on the legs. Pubescence brownish, dense but shorter than in the worker so that the body is less silvery.

Black; gaster dark brown, genitalia and legs yellow; the middle portions of the femora and the genital appendages sometimes infuscated, scapes and mandibles often reddish or yellowish.

Central and Southern Europe and Asia Minor (Caucasus Mountains).

This species nearly always nests in pure sand or sandy soil, preferring river and lake bottoms. It forms huge colonies often extending over many nests, the entrances of which are not surmounted by mounds but only by small, obscure craters. The color of the worker and female is variable, being sometimes as dark as the typical *fusca*, in other colonies more like *rufibarbis*. Specimens of the former coloration were called *fusco-cinerea* by Forel, of the latter *cinereo-rufibarbis*. It is doubtful, however, whether these represent transitions to *fusca* and *rufibarbis*. They may be hybrid forms.

104. F. cinerea cinerea var. fusco-cinerea Forel.

F. fusco-cinerea Forel, Denkschr. Schweiz. gesell. naturw., 1874, **26**, p. 55, 57, 58, ☿ ♀ ♂.

F. cinerea var. *fusco-cinerea* Dalla Torre, Catalog. Hymen., 1893, **7**, p. 194.

Worker and Female. Intermediate in pilosity and pubescence and also in habits between *F. fusca* and *cinerea*.

Male. Apparently indistinguishable from the male of the typical *cinerea*.

Zürich and Canton Vaud, Switzerland. Emery does not recognize this form in his revision of the Palaearctic Formicae. It is probably very closely related to the form described below as var. *altipetens* from Colorado.

105. F. CINEREA CINEREA var. IMITANS Ruzsky.

F. cinerea var. *imitans* Ruzsky, Ants envir. Aral Sea (Russian), 1902, p. 10, nota ☿ ; Zool. jahrb. Syst., 1902, **17**, p. 472; Formicar. Imper. Ross., 1905, p. 405, ☿ ♀.

F. fusca cinerea var. *imitans* Emery, Deutsch. ent. zeitschr., 1909, p. 199.

WORKER. Length 5–6.5 mm.

Pubescence dense, giving the body a silky luster. Erect hairs rather abundant, sparse on the thorax, more numerous on the gaster, long on the gula.

Color pale, resembling that of *F. rufibarbis*, the body being light reddish brown, the gaster dark brown, the legs only slightly darker than the thorax. Head and pronotum above each with a brown spot, or the whole body dark brown above. Small workers darker.

Ssamara and Orenburg in Western Siberia, Kirghis Steppe, Caucasus.

106. F. CINEREA CINEREA var. ARMENIACA Ruzsky.

F. cinerea var. *armeniaca* Ruzsky, Formicar. Imper. Ross., 1905, p. 406, ☿ ♀.

F. fusca cinerea var. *armeniaca* Emery, Deutsch. ent. zeitschr., 1909, p. 199.

WORKER. Length 5–7 mm.

Hairs not as numerous as in the typical *cinerea;* color darker, the head, gaster, and funiculi dark or blackish brown; petiole, scapes, mandibles, and legs brown. Specimens of still darker color and somewhat more abundant pilosity and pubescence occur and form a transition to the typical form.

FEMALE. Length 9–11 mm.

Resembling the typical form except in the gaster, which is hairless and shining.

Caucasus Mountains.

107. F. CINEREA CINEREA var. ALTIPETENS, var. nov.

WORKER. Length 3.5–6 mm.

Shape of thorax like that of the worker *fusca*, with the epinotum more angular and its declivity less sloping in profile, the mesoëpinotal constriction deeper and the pro- and mesonotum more convex. Petiole broad, seen from behind cordate, the border notched in the middle and much sharper than in the typical *cinerea*.

Surface of body a little more shining, being more delicately shagreened. Frontal area opaque. Mandibles subopaque, coarsely striatopunctate.

Hairs less abundant than in the typical *cinerea*, absent on the sides of the head and thorax; only a few long erect hairs on the gula. Legs without erect or oblique hairs on their flexor surfaces. Pubescence dense, but shorter and less silvery than in the typical *cinerea*.

Color of body as in the darker forms of the European type; mandibles, cheeks, anterior border of clypeus, antennae, except the tips of the funiculi, petiole, and legs dark red or brownish.

Female. Length 7 mm.

Closely resembling the worker in sculpture, pilosity, and color. Hairs shorter and less abundant than in the female *cinerea* and as in the worker absent on the sides of the head and thorax. Wings colorless and more transparent than in the typical form, with pale brown veins and darker stigma.

Male. Length 7–8 mm.

Differing from the male of the typical *cinerea* in the same characters as the worker and female, the body being smoother, less pilose and more delicately pubescent. There are very few erect hairs on the gula and there are none on the legs. Gaster dark brown; genitalia distinctly infuscated. Antennae black, like the head, thorax, and petiole; legs clear yellow. Mandibles very narrow, edentate, with long points, black, with brownish tips. Wings as in the female.

Described from many workers, two males, and a single rather immature female from Florissant, Colorado (8,100 ft.). I have also found this variety on Cheyenne Mountain, near Colorado Springs at about the same elevation. At first sight it would seem to be a hybrid between *F. fusca* var. *argentea* and the next variety, *neocinerea*, but the latter does not occur at Florissant, being peculiar to lower altitudes, and the var. *altipetens* is extremely common in the type locality, where it forms populous colonies which inhabit large earthen mound-nests (2–3 ft. in diameter and 6–10 inches high), overgrown with grass in the alpine meadows. It also nests under stones in the same stations. It is enslaved by *Polyergus breviceps* and the alpine forms of *F. sanguinea*.

108. F. cinerea cinerea var. neocinerea Wheeler.

F. cinerea Wheeler, Amer. nat., 1902, **36**, p. 947.
F. cinerea var. *neocinerea* Wheeler, Ants, 1910, p. 571.

Worker. Length 3–6 mm.

Shape of thorax varying from that of the var. *altipetens* to that of the typical *cinerea*. Petiole more as in the latter form, the border being sharper and broader, but usually entire and sometimes bluntly angular in the middle.

Body but slightly more shining than in *cinerea*.

Pilosity and pubescence more abundant than in the var. *altipetens* but less abundant than in the typical *cinerea*, the erect hairs lacking on the sides of the head, pleurae, and extensor surfaces of the legs as in the former. Pubescence long and dense, but less silvery than in the European form.

Body dark brownish, with the top of the head, the gaster and sometimes the thoracic dorsum darker and more blackish. Antennal scapes scarcely infuscated at their tips.

Female. Length 8–10 mm.

Closely resembling the worker in color, sculpture, and pilosity, but sides of head and thorax with sparse erect hairs as in the female of the typical *cinerea*. Mesonotum with three large fuscous blotches which are confluent behind, the mesopleurae, scutellum, metanotum, and base and sides of epinotum also fuscous. The red color of the anterior part of the head often extending back onto the front. Wings colorless, with pale brown veins and darker stigma.

Male. Length 7–8 mm.

Closely resembling the male of the var. *altipetens* but the erect hairs on the head and thorax are more abundant and the genital appendages are less infuscated. The antennal scapes, bases of funiculi, and in most specimens also the mandibles are sordid yellow. Wings as in the female.

Type locality.— Illinois: Rockford (Wheeler).

Illinois: New Bedford (G. E. Sanders).

Indiana: Wilders (W. S. Blatchley).

South Dakota: Harding County (S. S. Visher).

Colorado: Breckenridge (P. J. Schmitt); Colorado Springs (Wheeler).

California: San José (H. Heath); Palo Alto, Santa Cruz Mountains (W. M. Mann); Mesa Grande, Russian R. (J. C. Bradley).

In color this variety approaches very closely the redder form of *cinerea* which Forel has called *cinereo-rufibarbis*. Like the variety *altipetens* it nests in meadows and bogs, but its nests, though equally populous, are usually much flatter mounds. This ant is fond of nesting in the natural "hummocks," which are so prominent a feature of the bogs and meadows of Illinois and the neighboring states.

109. F. cinerea cinerea var. rutilans, var. nov.

Worker. Length 4–5 mm.

Head large and broad, thorax shaped like that of *fusca*, petiole much compressed anteroposteriorly, with very feebly convex anterior and

flat posterior surface, cordate when seen from behind, broad above, narrow below, its edge thin and sharp and narrowly excised in the middle.

Head and thorax opaque; gaster very feebly shining.

Hairs yellow, somewhat less abundant than in the typical *cinerea*, absent on the sides of the head and mesopleurae. Pubescence grayish, dense, but more delicate than is the tyical form, especially on the head and thorax, so that the surface is much more exposed.

Light yellowish red; top of head or at least the ocellar triangle, a large spot on the pronotum, the upper surface of the gaster and the tips of the funiculi brown.

Described from a dozen workers taken at Rockford, Illinois from a single colony occupying a very low mound-nest not unlike those constructed by the var. *neocinerea*. This variety is extremely close to the var. *imitans*, but differs from it in lacking the prominent erect hairs on the sides of the head and thorax and in the slightly less abundant hairs on other parts of the body.

110. F. CINEREA CINEREA var. LEPIDA, var. nov.

WORKER. Length 3.5–6.5 mm.

Very similar in the structure of the thorax and petiole to the typical European *cinerea*, the epinotum being rather low and rounded, especially in smaller workers, and the petiole narrow and blunt.

The sculpture and pilosity are also very similar to the European type, the erect hairs being present on the sides of the head although absent on the pleurae. Legs with small, erect, scattered hairs on their extensor surfaces. The pubescence is dense and glistening white, even more silvery than in the European form, most conspicuous on the gaster though equally dense on the head and thorax.

Color reddish yellow; antennae darker, posterodorsal surface of head blackish brown; gaster brown above, paler than the top of the head and sometimes scarcely darker than the thorax, which may be very feebly infuscated.

Described from numerous specimens taken by Mr. J. C. Bradley at Blue Lake, Humboldt County, California. Except in color, this is the most closely related of all our North American varieties of *cinerea* to the typical form. It also closely resembles the subspecies *pilicornis* in general appearance and color, but may be readily distinguished by the absence of erect hairs on the antennal scapes and eyes and the less abundant pilosity of other parts of the body.

111. F. CINEREA PILICORNIS Emery.

F. fusca var. *cinerea* Mayr, Verh. Zool. bot. ver. Wien, 1886, **36**, p. 427, ☿.
F. pilicornis Emery, Zool. jahrb. Syst., 1893, **7**, p. 664, ☿ ♀ ♂.

WORKER. Length 3–7 mm.

Thorax and petiole very much as in the typical *cinerea;* but in large workers the pro- and mesonotum are very convex and rounded. Petiole rather narrow, thick, with blunt, entire or feebly emarginate superior border.

Body, including the frontal area, opaque; mandibles densely striated and coarsely punctate.

Hairs silvery white, short, pointed, more abundant than in the typical *cinerea,* covering not only the whole body, but also the scapes, legs, and eyes. Pubescence silver gray, very dense and longer than in *cinerea,* uniformly investing the head, thorax, and gaster, much shorter on the legs and scapes.

Brownish red; mandibles darker, tips of funiculi, posterodorsal portion of head and dorsal portion of gaster dark brown, but appearing gray on account of the dense pubescence.

FEMALE. Length 8–10 mm.

Closely resembling the worker in sculpture, pilosity, and color. Three large spots on the mesonotum, the scutellum, metanotum, and sometimes also the pleurae and base of epinotum infuscated. In some specimens the mesothoracic spots become confluent so that the whole dorsal surface of the thorax is fuscous. Wings colorless, with pale yellow veins and darker stigma.

MALE. Length 8–9 mm.

Very similar in color, sculpture, and pilosity to the male of the typical *cinerea,* but the scapes have sparse, erect hairs on their anterior surfaces and the eyes are hairy. The upper surface of the gaster is also sparsely hairy. Body, including mandibles and antennae, black; genitalia and legs yellow; in some specimens the middle portions of the femora are deeply infuscated. Frontal area opaque. Wings as in the female.

TYPE LOCALITY.— California.

California: San Jacinto, Tres Pinos (Th. Pergande); Mount Pinos (F. Grinnell Jr.); Point Loma, San Diego County (P. Leonard and Wheeler); Arroyo Seco at Pasadena, Lakeside (Wheeler); Escondido, San Diego County (J. C. Bradley); Claremont (C. F. Baker); Lake Merced, near San Francisco (F. X. Williams).

This beautiful ant was described as a distinct species by Emery, but it is really only a very pilose subspecies of *cinerea,* peculiar to the

Fig. 8.— Distribution of the Nearctic forms of *Formica cinerea*.

low elevations on the slopes of the Coast Range in California. I have found great numbers of its colonies in the sandy bottom of the Arroyo Seco at Pasadena and in the sandy soil about the lake at Lakeside in El Cajon Valley. In the former locality it was living under large stones, in the latter it formed scattered crater nests, much like those of the typical *cinerea* in sandy portions of the Rhone Valley in Switzerland.

112. F. MONTANA Emery.

F. subpolita var. ? *montana* Emery, Zool. jahrb. Syst., 1893, **7**, p. 663, ♀.
F. subpolita var. *montana* Wheeler, Ants, 1910, p. 571.

WORKER. Length 4–4.5 mm.

Closely resembling *F. cinerea* in shape, sculpture, and pilosity. Head longer than broad, narrower in front than behind, with broadly rounded posterior corners and feebly convex sides. Eyes large. Clypeus rather bluntly carinate, its anterior border projecting, entire and broadly rounded. Frontal carinae diverging behind. Antennae moderately long, the scapes slightly enlarged at their tips; joints 2–5 of the funiculus more slender and slightly longer than the penultimate joints. Maxillary palpi rather long. Pro- and mesonotum feebly convex, mesoëpinotal constriction shallow, epinotum with subequal base and declivity, the former straight, forming a blunt obtuse angle with the very sloping declivity. Petiole rather narrow, slightly convex in front, flattened behind, the border not very sharp, seen from behind straight and transverse. Gaster and legs of the usual configuration.

Opaque and very densely shagreened; mandibles striatopunctate, glossy. Frontal area slightly shining.

Hairs pale yellow, abundant, erect, present on the dorsal and gular surface of the head, the thorax, petiole, and gaster; scapes and legs without erect or oblique hairs. Pubescence silvery white, very short, but rather dense, giving the head, thorax, and gaster a pruinose appearance.

Pale reddish brown, posterodorsal portion of head, tips of mandibles and of funiculi somewhat darker.

TYPE LOCALITY.— Nebraska: (Th. Pergande).

Redescribed from one of the cotypes kindly given me by Professor Emery. At first sight this species seems to resemble *F. bradleyi* of the *sanguinea* group, but closer examination discloses many differences. The latter species has a differently shaped head, smaller eyes, a notched clypeus, a shining surface, and much sparser and longer pubescence. I am inclined to believe that *montana* is merely a

variety of *cinerea* allied to *rutilans*, but as I have seen only a single specimen, I have merely removed it from *subpolita*, to which it was doubtfully referred by Emery. It certainly has no close relationship to that species.

113. F. SIBYLLA, sp. nov.

WORKER. Length 5–6.5 mm.

Head, excluding the mandibles, somewhat longer than broad, a little narrower in front than behind, with straight sides and slightly convex posterior border. Eyes small. Clypeus very sharply carinate, its anterior border entire, angularly produced in the middle. Maxillary palpi rather long. Frontal carinae slightly diverging posteriorly. Antennae long and slender; scapes very feebly curved at the base, not enlarged distally, funicular joints long and the basal ones slender. Thorax long, pro- and mesonotum only moderately convex, mesoëpinotal constriction shallow, base of epinotum feebly convex, distinctly longer than the sloping, slightly concave declivity. Petiole narrow, thick below, its anterior surface convex below, flattened above, posterior surface flat; border rather sharp, entire or very feebly notched in the middle which is slightly produced upward. Legs rather long and slender.

Opaque; body with a faint bronzy luster in certain lights. Mandibles very finely striated, with scattered, shallow punctures. Clypeus and head, including the frontal area, coarsely and densely, thorax and gaster a little more finely shagreened.

Hairs whitish, long and very sparse on the clypeus, upper surface of head, gula, and fore coxae; shorter and more obtuse on the gaster, except at its tip; almost absent on the thoracic dorsum. Legs without hairs, flexor surfaces of tibiae beset with a sparse row of bristles. Pubescence silvery grayish, very short and dense, covering the head, thorax, petiole, and gaster, even finer and slightly sparser on the legs.

Body black; cheeks, clypeus and legs dark reddish brown; mandibles, antennae, tarsi, and articulations of legs red; tip of terminal funicular joint infuscated.

MALE. Length 9–10.5 mm.

Mandibles broad, with three to four distinct teeth. Head flattened, as broad as long, much narrowed in front, with straight posterior border and cheeks. Eyes narrow, more than twice as long as broad, very convex. Clypeus projecting, distinctly carinate only on its anterior half. Thorax and gaster robust. Petiole low and thick, seen from behind with straight, entire, blunt border. Genitalia considerably withdrawn. Wings long (11 mm.).

Head and thorax, including the mandibles and frontal area, opaque, densely punctate, the pronotum also obscurely reticulate-rugose. Gaster coarsely shagreened, feebly shining.

Hairs and pubescence grayish, both abundant, covering the whole body, the erect hairs on the head, clypeus, gula, mesonotum, scutellum, petiolar border and both the upper and lower surfaces of the gaster being very conspicuous and the pubescence being unusually long, though not sufficiently abundant to conceal completely the ground surface. Eyes hairless.

Black; genitalia and tips of mandibles red; legs yellowish red, with the middle portions of the femora blackened. Wings uniformly and moderately infuscated, with pale brown veins and dark brown stigma.

Described from four workers and two males taken from a single colony by Prof. C. F. Baker in King's Canyon, Ormsby County, Nevada. The specimens were nesting under a log.

At first sight one would not hesitate to regard this ant as *F. fusca* var. *subsericea*, but closer examination shows it to be quite distinct. The eyes of the worker are much smaller than those of *subsericea*, the antennae are more slender, with less curved scapes, it has prominent hairs on the gula and the surface of the body is bronzy and not so black. The male is very different from the male *subsericea* in having smaller eyes, broad, toothed mandibles, a much more pronounced sculpture and very different pilosity and pubescence.

114. F. SUBRUFA Roger.

F. subrufa Roger, Berlin. ent. zeitschr., 1859, **3**, p. 236, ☿ ; Mayr, Europ. Formicid., 1861, p. 46, ☿ ; Ern. André, Rev. mag. zool., 1874, ser. 3, **2**, p. 183; Spec. Hymén. Europe, 1882, **2**, pt. 14, p. 181, ☿ ; Dalla Torre, Catalog. Hymen., 1893, **7**, p. 212; Emery, Zool. jahrb. Syst., 1894, **7**, pl. 22, fig. 20, ☿ ; Deutsch. ent. zeitschr., 1909, p. 199, ☿ ♀ ♂ ?, fig. 10.

WORKER. Length 5–6.5 mm.

Body slender; head, excluding the mandibles, distinctly longer than broad, narrower in front than behind, with nearly straight posterior and lateral borders and rounded posterior corners. Eyes rather large, convex. Clypeus strongly carinate, its anterior border produced, feebly sinuate or trunate in the middle. Frontal carinae diverging behind. Maxillary palpi long, 6-jointed. Antennae slender, scapes not incrassated towards their tips. Thorax narrow, with moderately rounded pro- and mesonotum and similarly rounded epinotum, separated by a very long, shallow, saddle-shaped mesoëpinotal constriction, so that the thorax is somewhat dumb-bell-shaped both in profile and when seen from above. Petiole narrow, cuneate in profile, thick below, compressed above, but with a blunt border which, seen

from behind, is rounded and entire. Legs long and slender. Opaque; surface of body peculiarly shagreened so that it has a silky luster irrespective of the pubescence. Mandibles very finely striated and with small, scattered, indistinct punctures.

Hairs glistening white, short, blunt, erect, abundant, covering the whole body, except the antennae and flexor surfaces of the legs. Pubescence very dilute and delicate, more distinct on the gaster than on the head and thorax.

Ferruginous brown; gaster dark brown; clypeus, cheeks, mandibles, tarsi, and articulations of legs paler, more yellowish red.

Female. Length 9 mm.

Similar to the worker in color and sculpture. Head somewhat broader than the thorax; clypeus feebly carinate, its anterior border more distinctly sinuate than in the worker. Thorax low, flat, with rounded epinotum. Superior border of petiole sharper than in the worker, but much blunter than in the female of *fusca*.

Male (?) Length 7–7.5 mm.; fore wing 5.5 mm.

Black; opaque throughout; tips of mandibles and the genitalia red, the stipes of the latter partly brown. Pubescence on the gaster long, whitish, not very dense; erect hairs very short. Head short and broad. Mandibles opaque; anterior border of clypeus rounded. Thorax depressed. Petiole thick, cuneate, its upper border not excised. Wings nearly colorless, with dark brown veins and stigma.

Iberian Peninsula and Southern France (Eastern Pyrenees).

The worker of this species is easily distinguished by its peculiar sculpture and, as Emery has pointed out, by the singular structure of the thorax in the mesoëpinotal region. I have redescribed the worker from two specimens collected by Prof. G. Strobl at Algeciras in Andalusia. The descriptions of the female and supposed male are taken from Emery.

115. F. subpolita Mayr.

F. fusca var. *subpolita* Mayr, Verh. Zool. bot. ver. Wien, 1886, **36**, p. 426, ☿ ♀.
F. fusca subsp. *subpolita* Emery, Zool. jahrb. Syst., 1893, **7**, p. 661, ☿ ♀.
F. gagates var. *subpolita* Dalla Torre, Catalog. Hymen., 1893, **7**, p. 199 (*in part*).
F. rufiventris Emery, Zool. jahrb. Syst., 1893, **7**, p. 665, pl. 22, fig. 11, ♂.
F. flammiventris, nom. nov. Wheeler, Psyche, 1912, **19**, p. 90, ♂.

Worker. Length 3–6 mm.

Distinctly dimorphic, the largest workers having the head large, rectangular, as broad as long and only slightly narrower in front than

behind, with straight posterior border and feebly convex sides; the small workers having the head much smaller, slightly longer than broad, with straight sides, and posterior borders and more rounded posterior corners. Eyes small; in the largest workers flat, in small workers more convex. Mandibles convex. Clypeus very strongly carinate, its anterior border subangularly produced in the middle. Frontal carinae diverging behind. Antennae stout; scapes rather strongly curved at the base, distinctly incrassated at their tips; funicular joints 2–4 narrower but scarcely longer than the penultimate joints; first funicular joint nearly as long as the second and third together, the second shorter than the third. Maxillary palpi rather short. Thorax short and robust; the pro- and especially the mesonotum very convex in the largest workers, the mesoëpinotal constriction short and deep, the epinotum with the base broadly convex in profile and distinctly shorter than the sloping declivity into which it passes through a rounded angle. In medium sized and small workers, the pro- and mesonotum are only moderately convex and the mesoëpinotal constriction is shallow. Petiole rather high and broad, compressed anteroposteriorly, with convex anterior and flat posterior surface; the border sharp and when seen from behind broadly rounded and entire. Gaster rather large; legs stout.

Surface of body shining, especially the gaster and posterior half of the head, finely shagreened. In the largest workers the mandibles, clypeus, front, cheeks, thorax, and petiole are opaque or subopaque and more coarsely sculptured; the mandibles and clypeus being sharply, densely, and longitudinally striate, the mandibles striatopunctate, the remaining opaque surfaces sharply shagreened. In medium and small workers the anterior portion of the head, including the mandibles, clypeus, and thorax, is distinctly shining and much more delicately shagreened. Frontal area in some specimens opaque, in others smooth and shining, apparently irrespective of the size of the specimen.

Hairs golden yellow, coarse, pointed, erect and very sparse, present on the clypeus, upper surface of the head, gula, pronotum, and gaster. Pubescence short and very sparse, with difficulty perceptible under an ordinary magnification even on the gaster; very fine and dense on the scapes.

Body varying from brownish red to dark chestnut-brown; legs paler and more yellowish; gaster and posterodorsal portion of the head black. Tips of antennal funiculi and sometimes also in large workers the middorsal portion of the pro- and mesonotum infuscated.

Female. Length 8–10 mm.

Resembling the worker, but the whole head opaque, finely and densely punctate behind, with coarsely striatopunctate mandibles and sharply striated clypeus. Frontal area opaque and finely punctate. Thorax subopaque, finely and densely punctate, except the

mesonotum and scutellum which are shining and very sparsely punctate. Gaster shining, very delicately shagreened and with minute, scattered piligerous punctures.

Pilosity and pubescence as in the worker.

Color variable. Most individuals have the head, thorax, petiole, and gaster black, the mandibles, legs, and antennae, except the tips of the funiculi, deep red. Others have the venter and base of the first gastric segment and the border of the petiole light red, and still others have the whole gaster and the petiole, except its extreme base, red. Wings grayish hyaline, with brown veins and stigma.

Male. Length 8–9 mm.

Mandibles edentate or indistinctly bidentate. Head small, broader than long, the posterior border broadly convex, the eyes large. Thorax and gaster robust, the latter flattened. Petiole rather high, somewhat compressed anteroposteriorly, transverse, its border rather sharp, seen from behind straight or feebly excised in the middle, rounded on the sides. Genitalia robust, tips of stipes not extending very far beyond the tips of the other appendages.

Somewhat shining; head and thorax a little more opaque, densely punctate. Frontal area rather smooth and shining in some specimens, in others subopaque.

Hairs and pubescence yellow, the former sparse, erect, distributed much as in the worker, but absent on the upper surface of the gaster. Eyes hairless. Pubescence dense but short and not completely concealing the surface.

Black; gaster and legs bright yellowish red; tips of mandibles reddish. Wings as in the female.

Type locality.— California: San Francisco.

California: Pacific Grove (H. Heath, W. M. Mann, Wheeler); Mount Lowe, summit 6,400 (W. Quayle, Wheeler); Palo Alto, Corte Madera Creek (W. M. Mann); Felton, Santa Cruz Mountains (J. C. Bradley); King's River Canyon (H. Heath); Baldy Peak, San Gabriel Mts. (Brewster, Joos, Crawford); Sierra Nevada, Marine County; Goat Island, San Gregorio.

Washington: Orcus Island (W. M. Mann).

Oregon: Corvallis (T. Kincaid).

British Columbia: Vancouver.

This is not a form of *F. fusca* as Mayr, Emery, and I have been supposing, but a very distinct species peculiar to the Pacific Coast. Its citation from the Eastern States and its allocation with *fusca* and *neogagates* has resulted from a study of the medium and small workers only and a failure to recognize the characters of the largest workers which represent a caste as distinct as the worker major of many

species of Camponotus. And, curiously enough, the shape of the head and the small size and flatness of the eyes in this caste remind one vividly of the Camponotus worker major. The male *subpolita* was originally described by Emery as a distinct species (*F. rufiventris*), but Mr. W. M. Mann has taken it on Orcus Island, Washington, flying (though not *in copula*) with females which undoubtedly belong to *subpolita*, and I have taken from colonies of this species at Pacific Grove, Cala., deälated females that have the color of the male, *i. e.* with black head, thorax, and petiole and the gaster of a peculiar yellowish red color.

F. subpolita nests under stones in grassy places, in Washington and Northern California at low elevations but ascends to considerable elevations (6,400 ft.) in the southern part of the latter state. The colonies are rather small and the workers are timid. At Point Joe, near Pacific Grove, I found many nests on the sea-shore and containing great numbers of coccids and pseudoscorpionids.

116. F. SUBPOLITA var. CAMPONOTICEPS, var. nov.

WORKER. Length 3–6.5 mm.

Differing from the typical form in the shape of the head and the color of the largest workers. The head is more distinctly rectangular than in the typical *subpolita*, and, excluding the mandibles, slightly broader than long, not narrower in front than behind, except very close to the insertions of the mandibles, with the cheeks straight behind and convex only anteriorly.

Sculpture of clypeus and head finer than in the typical form. Mandibles more superficially striated and shining. Frontal area smooth and shining in some specimens, opaque in others.

Body and legs yellow or yellowish brown, the posterodorsal portion of the head brown, the gaster blackish brown, the mesonotum with a large dark brown spot, the pronotum with a paler and more indefinite spot. Legs clouded with brown. Mandibles bright red. Smallest workers dark like those of the typical form.

TYPE LOCALITY.— Washington: Wawawai (W. M. Mann).

Washington: Rock Lake (W. M. Mann); Govan (J. A. Hyslop); Almota (A. L. Melander).

The head of the maxima worker of this variety is even more camponotiform than that of the typical *subpolita*, owing to the straight sides and more sudden narrowing at the insertion of the mandibles. I am not certain that the smallest workers described as darker in color belonged to the same colony as the largest specimens. The medium workers are pale in color like the largest.

Subgenus PROFORMICA Ruzsky.

117. F. (P.) neogagates neogagates Emery.

F. fusca var. *gagates* Mayr, Verh. Zool. bot. ver. Wien, 1886, **36**, p. 426, ☿ .
F. gagates var. *subpolita* Dalla Torre, Catalog. Hymen., 1893, **7**, p. 199.
F. fusca subpolita var. *neogagates* Emery, Zool. jahrb. Syst., 1893, **7**, p. 661, ☿ ♀ ♂; Wheeler, Bull. Amer. mus. nat. hist., 1904, **20**, p. 306; Occas. papers Bost. soc. nat. hist., 1906, **7**, no. 7, p. 21; Forel, Ann. Soc. ent. Belg., 1904, **48**, p. 153.
F. fusca subpolita Wheeler, Bull. Amer. mus. nat. hist., 1906, **22**, p. 345.

Worker. Length 2.5–5.5 mm.

Head even in the largest workers longer than broad, distinctly narrower in front than behind, with very feebly convex cheeks and posterior border and broadly rounded posterior angles. Eyes rather small, but convex, their long axes decidedly shorter than the distance between their anterior border and the anterior corners of the head. Clypeus sharply carinate, its anterior border angularly produced in the middle. Antennae rather slender, scapes but slightly enlarged towards their tips; first funicular joint as long as the two succeeding joints together; these two joints subequal and each slightly shorter than the penultimate joints. Maxillary palpi moderately long. Frontal carinae not abbreviated, scarcely diverging behind. Thorax slender, pro- and mesonotum moderately convex, mesoëpinotal constriction moderately deep, epinotum with subequal base and declivity, usually rounded, without distinct base and declivity but in some specimens more angular. Petiole narrow, with convex anterior and flat posterior surface and rather blunt border, which is entire and rounded when seen from behind. Gaster small; legs slender.

Surface of body smooth and shining, very finely and superficially shagreened. Mandibles and clypeus very finely and densely, longitudinally striated. In the largest workers the anterior half of the head and the thorax may be subopaque. Frontal area smooth and usually shining.

Hairs white, delicate, erect, rather blunt, abundant and moderately long, present on the upper surface of the head, the gula, whole upper surface of thorax, petiole, and gaster. Pubescence white, very sparse but long and distinct on the gaster and legs, and often also on the head and thorax; very fine and dense on the antennal scapes.

Black or very dark brown, the thorax and petiole often more or less piceous or reddish brown, with paler sutures; the head and gaster usually with bronzy reflections; mandibles, antennae, legs, and sometimes also the cheeks and clypeus red; femora sometimes infuscated in the middle.

Female. Length 6–8 mm.

Clypeus not projecting but with its anterior border truncated or even slightly sinuate in the middle. Resembling the worker in sculpture and pilosity, the hairs, however, longer and more pointed, especially on the gaster. Head, thorax, petiole, and gaster black, or more rarely dark brown; mandibles, clypeus, cheeks, antennae, and legs deep red. In some specimens the antennae and legs are more yellowish and in some the thorax is rich chestnut-brown, clouded with black. Mesonotum and scutellum usually smoother and more shining than the pronotum, pleurae, and epinotum. Wings colorless, with pale brown veins and scarcely darker stigma.

Male. Length 6–7.5 mm.

Mandibles rather broad, edentate. Head broader than long, very broadly rounded behind, strongly narrowed in front, with large eyes and prominent ocelli. Clypeus indistinctly carinate, with rounded anterior border. Thorax and gaster slender. Petiole thick and broad, its upper border very blunt, broadly rounded and entire when seen from behind. Genitalia slender; stipes narrow and rather pointed, extending a considerable distance beyond the volsellae and sagittae.

Body subopaque; gaster somewhat shining; head finely, thorax more coarsely punctate; frontal area opaque.

Hairs gray, erect, abundant on the upper surface of the head, gula, thoracic dorsum, and mesopleurae, slightly less abundant on the petiole and gaster. Pubescence gray, long, moderately dense on the body, very fine and denser on the appendages.

Black; antennae and gaster dark brown; genitalia and legs yellow; middle portions of femora strongly, genital appendages more feebly infuscated. Wings colorless as in the female, with brown veins and stigma.

Type locality.— Pennsylvania; Beatty, (P. J. Schmitt).

New Jersey: Paterson (Wheeler).

New York: Kiamesha (C. T. Brues); Niagara Falls; Ithaca (Cornell Univ. Coll.).

Connecticut: Kent, Salisbury (W. E. Britton); Norfolk, Colebrook (Wheeler).

Massachusetts: Essex County (G. B. King); Chestnut Hill, Forest Hills (Wheeler).

New Hampshire: White Mountains (W. F. Fiske).

Maryland: (Theo. Pergande).

North Carolina: Gray Beard Mount, Blue Ridge (W. Beutenmüller).

Illinois: Algonquin (W. A. Nason).

S. Dakota: Hill City (Th. Pergande).

Montana: Elkhorn, Nigger Hill (W. M. Mann).

Utah: (Amer. Mus. Nat. Hist. Coll.).

Colorado: Colorado Springs, Colorado City, Manitou, Florissant, Wild Horse, Buena Vista (Wheeler); Boulder (T. D. A. Cockerell).

New Mexico: Las Vegas (E. Tuttle, K. Tipton); Glorieta, Pecos (T. D. A. Cockerell); Albuquerque (Wheeler); Las Valles (Miss Mary Cooper); Alamogordo (G. v. Krockow).

Arizona: Ash Fork, Coconino Forest at the Grand Canyon, Williams (Wheeler); Flagstaff (F. E. Pratt).

Wyoming: Carbon County (Amer. Mus. Nat. Hist. Coll.).

Washington: Almota (A. L. Melander); Pullman (R. W. Doane, W. M. Mann); Wawawai (W. M. Mann).

Ontario: Guelph (Wheeler).

Quebec: Kingsmere (Wheeler).

Nova Scotia: Digby (J. Russell).

British Columbia: Vermillion Pass, 5,000–6,500 ft. (E. Whymper).

Alberta: (E. Whymper).

Emery regarded this ant as a variety of *F. subpolita* but it is certainly quite distinct, though its worker resembles the small workers of the latter species. *F. neogagates*, however, differs in its more abundant, more delicate and paler pilosity and in the proportions of the basal funicular joints of the worker. The male differs greatly from the male *subpolita* in color and in the structure of the genitalia. I had referred the species to Proformica before I noticed that Emery regarded his *F. lasioides*, which is merely a subspecies of *neogagates*, as belonging to this subgenus. In certain respects it is a connecting link between Proformica and the subgenus Formica, the frontal carinae not being abbreviated as in the Old World species of the former group.

F. neogagates is a very timid ant which nests in small colonies under stones in open, often very dry and stony country. In the Rocky Mts. its colonies are abundant at altitudes between 6,000 and 8,000 ft., in the Eastern States it is much rarer and more sporadic and, though preferring the hills of the Appalachian system, may descend almost to sea level. It is, however, properly a subboreal species and even in the latitude of New York is rarely found at low elevations. Like the forms of *F. fusca* it is readily enslaved in all parts of its range by the various subspecies of *F. sanguinea*.

118. F. (P.) NEOGAGATES NEOGAGATES var. MORBIDA, var. nov.

WORKER. Length 3–4 mm.

Differing from the typical *neogagates* in the smaller average size and in color. The body is reddish or brownish yellow, the legs and an-

tennae often paler yellow, the head and mandibles, especially the posterodorsal portion of the former, somewhat darker red, the gaster pale brownish above and posteriorly. Palpi brown. Hairs and pubescence yellowish, the former slightly coarser than in the typical form.

Female (deälated). Length 6 mm.

Sculpture, pilosity, and pubescence as in the worker; mesonotum and scutellum smooth and shining.

Body brownish yellow; gaster with a short, indistinct, transverse, reddish brown band on each segment; head with a band of the same color between the eyes. Mandibles reddish brown, sutures of thorax fuscous or blackish. Legs and antennae, including the funiculi, concolorous with the body.

Described from nine workers and a single female taken by Rev. P. J. Schmitt, O. S. B., at Lenox, Iowa.

119. F. (P.) neogagates neogagates var. vinculans, var. nov.

Worker. Length 2.5–4.5 mm.

In size and pilosity like the preceding variety, in color intermediate between it and the typical *neogagates*. Head, thorax, petiole, legs, and antennae yellowish red, gaster dark brown or blackish, posterodorsal portion of head castaneous, in some specimens nearly as dark as the gaster.

Female. Length 6 mm.

Color and pilosity much as in the worker, but the red of the body deeper and the mesonotum with three very large and nearly confluent, castaneous blotches. Base of first gastric segment red. Wings colorless, with resin-yellow veins and stigma.

Described from five workers taken by myself at Rockford, Illinois, and a single female taken by Mr. W. A. Nason at Algonquin in the same state.

120. F. (P.) neogagates lasioides Emery.

F. lasioides Emery, Zool. jahrb. Syst., 1893, **7**, p. 664, ♀ ; Wheeler, Ants, 1910, p. 571.

F. (*Proformica*) *lasioides* Emery, Zool. jahrb. Suppl., 1912, **15**, p. 100 *nota*.

Worker. Length 3.5–4.5 mm.

Differing from the typical *neogagates* in its somewhat smaller size, in color, pilosity, and the somewhat shorter legs and antennae.

Body shining, very finely reticulate-striolate or shagreened and very sparsely and finely punctate. Mandibles finely striate.

Pubescence scarcely visible, extremely short and sparse; hairs erect, rather abundant, white and delicate; gula with long hairs. Legs with somewhat oblique, sparse pubescence. Anterior surface of antennal scapes covered with numerous short, erect hairs.

Yellowish brown; antennae and legs paler; gaster and posterodorsal portion of head darker brown.

Type locality.— South Dakota: Hill City (Th. Pergande).

Colorado: Manitou (Wheeler).

Massachusetts: Wellesley (A. P. Morse); Amherst (Amherst College Coll.).

Professor Emery has very generously given me one of the three cotypes of this ant, which he described in 1893 as a distinct species. This specimen agrees well with the material from Massachusetts except that the latter is somewhat darker in color. As Professor Emery has also sent me cotypes of his *lasioides* var. *picea* (*vetula*) and his *neogagates*, I am able, with the aid of the large amount of material in my collection, to form a definite opinion on the status of these various forms and their relations to one another. Both the typical *lasioides* and its var. *picea* were based on small workers and this evidently led Emery to regard them as representatives of a distinct species. Long series of specimens, however, collected from many localities, show that they differ from the typical *neogagates* and its var. *morbida* merely in having erect hairs on the antennal scapes. The differences mentioned by Emery in the length of the scapes and tibiae are, in my opinion, slight and inconstant.

121. F. (P.) neogagates lasioides var. vetula Wheeler.

F. lasioides var. *picea* Emery, Zool. jahrb. Syst., 1895, **8**, p. 335, ☿ ; Wheeler, Ants, 1910, p. 571.

F. fusca subpolita var. *picea* Wheeler, Occas. papers Bost. soc. nat. hist., 1906, **7**, no. 7, p. 21.

F. lasioides var. *vetula*, nom. nov. Wheeler, Psyche, 1912, **19**, p. 90.

Worker. Length 2.5–5.5 mm.

Resembling the worker of the typical *neogagates* in size, color (even to the variations of color), sculpture and pilosity, and differing only in having delicate, short, erect, white hairs on the anterior surface of the antennal scapes as in the typical *lasioides*.

Female. Length 6–8 mm.

Differing from the female of the typical *neogagates* only in having short hairs, like those of the worker, on the anterior surfaces of the scapes.

MALE. Length 6–7.5 mm.

Indistinguishable from the male of the typical *neogagates*. Antennal scapes without erect hairs.

TYPE LOCALITY.— British Columbia: Yale, (Dieck).

Ontario: Ottawa (Centr. Exper. Farms. Coll.).

Nova Scotia: Digby (J. Russell).

South Dakota: Hill City (Th. Pergande); Harding County (S. S. Visher).

Montana: Helena, Elkhorn (W. M. Mann).

Colorado: Boulder (P. J. Schmitt, S. Rohwer); Minnehaha Falls, Pike's Peak, 8,400 ft. (T. D. A. Cockerell); Woodland Park, 8,000 ft., Ute Pass, Manitou, Colorado Springs, Florissant, 8,100 ft. (Wheeler).

New Mexico: Beulah, 8,000 ft. (T. D. A. Cockerell); Gallinas Canyon (Miss Mary Cooper); Cloudcroft (H. Skinner).

Nevada: Pyramid Lake (W. M. Mann).

Washington: Pullman (W. M. Mann); Olympia, Friday Harbor (T. Kincaid).

Idaho: Moscow Mt. (J. M. Aldrich).

California: Giant Forest, Sequoia National Park, 6,000–7,000 ft. (J. C. Bradley); Pacific Grove (H. Heath, W. M. Mann, Wheeler).

Illinois: Rockford (Wheeler).

Wisconsin: Milwaukee (C. E. Brown).

Michigan: Porcupine Mts. (O. McCreary).

Connecticut: Colebrook, Norfolk (Wheeler); Stafford (W. E. Britton).

Massachusetts: Blue Hills (Wheeler); Wellesley (A. P. Morse); Essex County (G. B. King); Woods Hole (Miss A. M. Fielde).

Vermont: Lyndon (A. L. Melander).

This variety, as the preceding list shows, has much the same distribution as the typical *neogagates* and is often found in the same localities. It forms colonies of the same size and also nests under stones in open places.

122. F. (P.) LIMATA, sp. nov.

WORKER. Length 3.5–5 mm.

Closely related to *F. (P.) neogagates*. Head, excluding the mandibles, longer than broad, narrower in front than behind, with convex

posterior and straight lateral borders. Eyes large, their long diameter nearly equal to the distance between their anterior border and the anterior border of the head. Clypeus strongly carinate, its anterior border entire and projecting, feebly angular or rounded. Antennae rather slender, scapes scarcely thickened at their tips; first funicular joint a little shorter than joints 2 and 3 together, which are subequal; joints 2–4 more slender but not longer than the penultimate joints. Thorax rather slender, pro- and mesonotum moderately convex, mesoëpinotal constriction moderately deep; epinotum in profile with subequal base and declivity, both rather straight in profile and forming a rounded but distinct obtuse angle with each other. Petiole narrow, not very thick at the base, its anterior surface somewhat convex, the posterior more flattened, the border rather sharp, seen from behind rounded and entire or feebly notched in the middle. Gaster small. Legs rather slender.

Mandibles and clypeus very finely longitudinally striated, the former subopaque, the latter and the remainder of the body very shining, the head, thorax, and gaster distinctly smoother than in *neogagates*, the shagreening of the surface being extremely delicate.

Hairs and pubescence yellowish, very sparse, the former erect and pointed, present on the clypeus, front, vertex and gula, fore coxae and gaster, absent on the thorax and petiole. The pubescence on the gaster is distinct but very sparse, much shorter and denser on the epinotum, legs, and scapes; scarcely perceptible on the head.

Thorax, petiole, legs, and antennae brownish yellow; head, tips of antennal funiculi and gaster dark brown; anterior half of head, including clypeus and mandibles paler and more reddish. Pro- and mesonotum often clouded with fuscous above.

Type locality.— Colorado: Florissant, 8,100 ft. (Wheeler).

Colorado: Ute, Cheyenne Canyon near Colorado Springs (Wheeler).

New Mexico: Las Vegas (Wheeler).

This species is readily distinguished from *neogagates* and small workers of *subpolita* by its much larger eyes, smoother and more shining surface, the sparseness of the hairs on the head and gaster, and their absence on the thorax. The last character, however, is not invariable, for one series of specimens from Cheyenne Canyon has a very few hairs on the mesonotum and posterior border of the epinotum. The specimens from Las Vegas are darker and colored more like *neogagates*. *F. limata* forms small colonies which nest under stones or in crater-nests on dry, stony slopes fully exposed to the sun.

123. F. (P.) NASUTA Nylander.

F. nasuta Nylander, Ann. sci. nat. Zool., 1856, ser. 4, **5**, p. 66, ☿ ; Ern. André, Spec. Hymén. Europe, 1882, **2**, pt. 14, p. 177, ☿ ; Forel, Ann. Soc. ent. Belg., 1886, **30**, p. 205, ☿ ; Nasonow, Arb. Lab. zool. Univ. Moskau, 1889, **4**, p. 61; Dalla Torre, Catalog. Hymen., 1893, **7**, p. 201.

F. aerea Roger, Berlin ent. zeitschr., 1859, **3**, p. 237, ☿ ; Ibid., 1861, **5**, p. 164.

Myrmecocystus nasutus Emery & Forel, Mitth. Schweiz. ent. gesell., 1879, **5**, p. 449; Emery, Ann. Mus. civ. Genova, 1880, **15**, p. 389 *nota* ☿ .

F. (*Proformica*) *nasuta* Ruzsky, Horae Soc. ent. Ross., 1903, **36**, p. 304, ☿ ; Formicar. Imper. Ross., 1905, p. 421, ☿ ♀ ♂; Emery, Deutsch. ent. zeitschr., 1909, p. 200, ☿ ♀ ♂; Zool. jahrb. Suppl., 1912, **15**, p. 100.

WORKER. Length 3–5.8 mm.

Head of small worker elongate, rounded behind, of large worker broader and more rectangular. Clypeus indistinctly carinate. Frontal carinae short and subparallel, frontal furrow distinct only in large individuals. Thorax long and low; its dorsal contour in profile angularly impressed in the mesoëpinotal region only in the larger workers; seen from above the pronotum is broader than the epinotum, twice as broad as the mesonotum and spherically convex. Petiole higher than broad, its border more rounded in small individuals, angularly excised in large specimens.

Body very shining; front and clypeus finely longitudinally striated, subopaque.

Erect hairs long and sparse; pubescence very sparse, in some specimens more abundant on the gaster and somewhat concealing the shining surface.

Brown; larger specimens piceous, often with faint metallic luster; mandibles, antennae, and legs paler.

FEMALE. Length, 7 mm., without the gaster 4.3 mm.

Head rather square, scarcely longer than broad, the scapes extending but little beyond the posterior corners of the head. Thorax narrower than the head, with parallel sides and flat dorsal surface. Petiole high, with sharp dorsal border, deeply and angularly excised in the middle.

Sculpture as in the larger workers; pubescence denser, gray; color somewhat darker.

MALE. Length 6–7.5 mm., of fore wings 5.5–6.2 mm.

Head rounded, somewhat longer than broad, the eye about $\frac{2}{3}$ the length of the lateral border. Petiole thick, its border obtuse, and seen from behind excavated in the middle. Gaster, excluding the genitalia, as long as the thorax, with distinct intersegmental constrictions; subgenital plate obtusely trilobed. Stipes slender projecting far beyond the volsellae and sagittae. Wings with a well-developed discoidal cell.

Surface of body smooth and very shining.

Hairs brown, long, very dense on the head, thorax, and venter; sparser on the dorsal surface of the gaster; legs with long, reddish, suberect hairs.

Black; funiculi, legs, and borders of gastric segments yellowish brown; genitalia brownish yellow. Wings faintly tinged with brown.

TYPE LOCALITY.— Southern France.

Iberian Peninsula, Balkan Peninsula, Southern Russia, Aralo-caspian Plain.

Emery calls attention to the fact that the range of this species is discontinuous, consisting of an eastern and a western region, widely separated from each other, and he admits his inability to detect any differences between eastern and western workers. He has seen male specimens from France and Spain and these agree closely with Ruzsky's description of oriental specimens. Forel, however, is inclined to believe that the eastern and western forms differ somewhat and he therefore refers at least some of the former to the variety *striaticeps*.

124. F. (P.) NASUTA var. STRIATICEPS Forel.

F. (*P.*) *nasuta* var. *striaticeps* Forel, Bull. Soc. Vaud. sci. nat., 1911, ser. 5, **47**, p. 352, ♀.

WORKER. Length 3–7 mm.

Differing from the typical form of *nasuta* from Southern France in having the head finely striated almost as far back as the occiput, and more abundantly punctate. The pubescence is also more distinct and more abundant, but nevertheless variable. Color paler and more brownish. The typical form of the species is a little smaller, almost devoid of pubescence and has only the clypeus and a part of the front striated; this sculpture, too, is usually feebler and the punctuation sparser.

TYPE LOCALITY.— Vicinity of Salonica.

Bulgaria, Tiflis, and the Caucasus.

Should further study prove that all the smoother eastern forms of *nasuta* belong to *nasuta*, the name *striaticeps* would have to be replaced by *aerea*, since Roger's types of this form came from Greece.

Forel states that the nests of *striaticeps* are feebly populated and that they are excavated in the earth of rather dry fields or in rocky places. The workers, which leave the nests at infrequent intervals, often return with the gaster much distended with liquid food after the manner of the species of Prenolepis.

125. F. (P.) KORBI Emery.

F. (*P.*) *korbi* Emery, Deutsch. ent. zeitschr., 1909, p. 202, ☿ ♀; Forel, Bull. Soc. Vaud. sci. nat., 1911, ser. 5, **47**, p. 353.

WORKER. Length 2.5–6.5 mm.

Structure and color of the body almost exactly the same as in *nasuta*.

Whole body, even in small specimens, opaque, owing to its fine sculpture, with a slight bronzy or steel-blue luster, most distinct on the gaster.

Pubescence dense, whitish and appressed. Hairs suberect, long, sparse, and obtuse.

FEMALE. Also very similar to *F. nasuta*. Pubescence as in the worker; color black, appendages paler.

Sultan-Dagh in Anatolia (M. Korb).

Forel believes that this form may eventually prove to be only a subspecies of *nasuta*.

126. F. (P.) MONGOLICA Emery.

F. nasuta subsp. *mongolica* Emery, Zichy III Asiat. forschungsreise, 1901, p. 159, ☿.

F. (*Proformica*) *mongolica* Emery, Deutsch. ent. zeitschr., 1909, p. 202.

WORKER. Length 2–4.2 mm.

Resembling the small worker of *nasuta* in color and sculpture, but the head is proportionally broader, the antennae shorter and thicker, the thorax much stouter, and the pronotum narrower in proportion to the posterior portion of the thorax. Pubescence sparse as in *nasuta*.

Chara-Gol in Mongolia.

Emery saw only a few specimens of this species and it is therefore doubtful whether larger ones occur.

127. F. (P.) ABERRANS Mayr.

F. aberrans Mayr, Fedtschenko's Turkestan. Formicid. 1877, p. 7, ☿; Tijdschr. ent., 1880, **22**, p. 27; Ern André, Spec. Hymén. Europe, 1882, **2**, pt. 14, p. 178, ☿; Dalla Torre, Catalog. Hymen., 1893, **7**, p. 192.

F. (*Proformica*) *aberrans* Ruzsky, Formicar. Imper. Ross., 1905, p. 421; Emery, Deutsch. ent. zeitschr., 1909, p. 203.

Worker. Length 5.5 mm.

Head longer than broad, much rounded behind. Clypeus carinate, its anterior border faintly emarginate in the middle. Frontal carinae subparallel and nearly straight. Petiole thick, with blunt, rounded superior border.

Slightly lustrous; head longitudinally, thorax in part transversely, finely, and sharply striolate; mandibles striatopunctate, gaster delicately transversely striolate.

Hairs suberect, moderately abundant; scapes and tibiae with short, whitish, suberect hairs; pubescence very sparse.

Black; mandibles, antennae, and legs brown.

Turkestan.

128. F. (P.) aberrans var. nitidior Forel.

F. (*P.*) *aberrans* var. *nitidior* Forel, Ann. Mus. St. Petersbourg, 1904, **8**, p. 383, ☿ ; Ruzsky, Formicar. Imper. Ross., 1905, p. 421, ☿ ; Emery, Deutsch. ent. zeitschr., 1909, p. 203, ☿ .

Worker. More shining than the typical *aberrans* and no more sharply sculptured than *F. gagates*.

Turkestan.

129. F. (P.) oculatissima Forel.

F. oculatissima Forel, Ann. Soc. ent. Belg., 1886, **30**, C. R. p. 161, ♂; Dalla Torre, Catalog. Hymen., 1893, **7**, p. 203.

F. (*Proformica*) *oculatissima* Emery, Deutsch. ent. zeitschr., 1909, p. 203, ♂.

Male. Length 7 mm.; anterior wings 7.3 mm.

Body slender; head small, with enormous eyes and ocelli. Mandibles edentate. Clypeus ecarinate; clypeal fovea distinctly separated from the antennal fovea. Thorax rather depressed, epinotum more sloping than in the other species of Proformica. Petiolar scale as thick as high, feebly emarginate above. Subgenital plate emarginate on each side, with rounded median lobe. Wings with a large discoidal cell.

Body shining.

Hairs suberect, rather abundant on the head, ventral surface of the body and genitalia, sparse on the thoracic dorsum and upper surface of the gaster, absent on the scape; tibiae with a few suberect hairs.

Black; antennae, mandibles, and coxae yellowish brown, remainder of legs yellow. Wings nearly colorless, with pale veins and brown stigma.

Greece.

130. F. (P.) KRAUSSI Forel.

F. kraussii Forel, Mitth. Schweiz. ent. gesell., 1895, **9**, ☿ ; Emery, Bull. Soc. ent. France, 1899, p. 18; Forel, Ann. Soc. ent. Belg., 1902, **46**, p. 155, ♂.
F. (*Proformica*) *kraussi* Emery, Deutsch. ent. zeitschr., 1909, p. 204, ☿ ♂.

WORKER. Length 3.2 mm.

Habitus more like that of Lasius than Formica. Head oval, narrower anteriorly; frontal carinae very short. Mandibles 5-toothed, with oblique border. Clypeus very bluntly carinate. Pronotum, seen from above, rounded, spherical, twice as broad as the mesonotum. Petiolar scale truncate, with rounded dorsal border.

Very shining, head less so, very finely rugulose; mandibles finely striated.

Surface scarcely pubescent, with numerous short, erect, obtuse, slightly clavate hairs. Legs with short, sparse pubescence.

Dark brown, gaster piceous with feeble bronze reflections.

MALE. Length 3.5 mm.

Body short. Eyes not especially large; mandibles narrow and pointed. Thorax high; petiole with bluntly rounded node. Gaster short. Volsellae of genitalia very short and slender. Anterior wings with large stigma and without a closed discoidal cell.

Body scarcely pubescent; suberect hairs as in the worker; tibiae with a few oblique bristles.

Piceous, head and tip of gaster almost black; appendages more or less reddish, femora darker.

Known only from Southern Algeria.

131. F. (P.) EMMAE Forel.

F. (*P.*) *emmae* Forel, Bull. Soc. Vaud. sci. nat., 1909, ser. 5, **45**, p. 381, ☿ ; Emery, Zool. jahrb. Suppl., 1912, **15**, p. 103, ☿ .

WORKER. Length 3–5.5 mm.

Mandibles 5-toothed, the apical tooth long; head as broad as long, with the posterior angles rounded and the posterior border scarcely convex. Fourth joint of maxillary palpi curved, as long as the two last joints together; third nearly as long as the fourth. Ocelli distinct. Eyes large, rather convex, situated at the posterior third of the head. Clypeus feebly carinate, the carina interrupted at its anterior third by a small transverse impression. Anterior border of clypeus straight, not projecting. Antennal scapes surpassing the posterior border of the head slightly even in the largest workers. First funicular joint $1\frac{1}{3}$ times as long as the second, all the other joints at least

twice as long as broad. Pronotum large; mesonotum very distinctly concave and saddle-shaped in profile, with an obtuse projection in front resembling the pommel of a saddle and a feeble posterior thickening formed mainly by the two projecting spiracles. Epinotum rather broad, with strongly convex basal surface, rising behind the mesonotum and a little longer than the declivity into which it passes insensibly. Petiole vertical, thick, much thicker than in *F. nasuta*, as thick above as at the base, convex in front, flat behind, with obtuse, rounded border, entire and rather transverse when seen from behind. Legs very slender.

Mandibles striatopunctate, rather shining. Body very shining; gaster nearly smooth, other portions of the body very feebly shagreened, a little more strongly and densely on the front of the head.

Front of clypeus with a row of long hairs; remainder of body glabrous, except for one or two small hairs on the head and towards the tip of the gaster. Mentum with ammochaetae. Tibiae with one, metatarsi with two rows of bristles on their flexor surfaces. Pubescence very short and very sparse on the appendages, almost *nil* on the body.

Black, scarcely tinged with brown. Mandibles, anterior border of head, antennae, legs, palpi, and the very narrow posterior border of each gastric segment brownish red; coxae and femora darker brown.

Biskra, Algeria (A. Forel).

This ant is remarkably like the species of Cataglyphis, especially in the structure of the thorax, petiole, and maxillary palpi and in possessing ammochaetae on the mentum. According to Forel, its colonies are very small and inhabit little nests the entrances of which do not open on craters but are very small round holes in the sand, difficult to discover unless one follows up workers that are returning to the nest.

Subgenus NEOFORMICA, subgen. nov.

132. F. (N.) pallidefulva pallidefulva Latreille.

F. pallidefulva Latreille, Hist. nat. fourm. 1802, p. 174, ☿ ; Dalla Torre, Catalog. Hymen., 1893, **7**, p. 203; Emery, Zool. jahrb. Syst., 1893, **7**, p. 656, taf. 22, fig. 16, ☿ ♀ ♂; Ibid., 1895, **8**, p. 335; Wheeler, Bull. Amer. mus. nat. hist., 1904, **20**, p. 369.

Worker. Length 4.5–6 mm.

Body long and slender. Mandibles 8-toothed. Head, excluding the mandibles, about $1\frac{1}{4}$ times as long as broad, but little narrower

FIG. 9.— Distribution of the subgenus Proformica in North America.

in front than behind, with convex and rounded posterior border and straight sides. Eyes moderately large, convex. Clypeus with broadly rounded and somewhat projecting, entire, anterior border, strongly carinate, the carina angular in profile. Frontal carinae parallel. Maxillary palpi very long, 6-jointed. Antennae very long and slender, the scapes straight at the base, funiculi not thickened towards their tips, the median joints more than $1\frac{1}{2}$ times as long as broad. Thorax, especially the pro- and mesonotum, long, these portions not very convex, evenly rounded; mesoëpinotal constriction not deep; epinotum low and evenly rounded, without distinct base and declivity. Petiole narrow, rather thick, its anterior and posterior surfaces convex, its margin blunt, rounded and entire when seen from behind or only slightly impressed in the middle. Gaster elongate elliptical; legs long.

Whole body shining and very finely and superficially shagreened; mandibles finely striated and coarsely punctate.

Hairs yellowish, sparse, confined to the gaster and the upper surface of the head; absent on the gula, thorax, and petiole; blunt and coarse on the gaster. Legs with only the graduated series of bristles on the flexor surfaces of the tibiae. Pubescence fine and rather dilute, visible on the gaster and legs.

Pale yellow; mandibles reddish; gaster often with a brownish tint; sometimes the whole head is reddish.

Female. Length 7–8 mm.

Rather stout; head nearly as broad as long, subrectangular, a little narrower than the thorax. Border of clypeus more flattened than in the worker, petiole more compressed anteroposteriorly, with flat posterior surface.

Sculpture and pilosity as in the worker, but the body, especially the head and mesonotum, more reddish. Wings colorless, with pale brown veins and stigma.

Male. (After Emery).

Characterized by its pale color. The whole body is yellow, the head and the gaster behind somewhat darker. Vertex and tips of funiculi brown; only the eyes black. Head much smaller than in the other subspecies. The eyes too are somewhat smaller.

District of Columbia: Washington (Th. Pergande).

Kansas: Osage City (A. C. Burrill).

Georgia: Tallulah Falls, Marietta, Ducker, Clayton, Clarkesville (J. C. Bradley).

New Jersey: Fort Lee (W. Beutenmüller).

New York: Bronxville (Wheeler).

I have not seen the male of this the typical form of the species but the male of the var. *succinea* described below is probably very similar.

Both are southern forms, the true *pallidefulva* being very rare as far north as New Jersey and New York. The species is very constant morphologically although it varies greatly in color, and pilosity. The males of all the forms I have seen are very slender, have very large eyes and resemble the males of the subgenus Proformica in having the stipes of the genitalia projecting considerably beyond the other appendages. What Mayr described as the female of *pallidefulva* from New Jersey, I believe with Emery to be the female of *F. difficilis*.

133. F. (N.) PALLIDEFULVA PALLIDEFULVA var. SUCCINEA Wheeler.

F. pallidefulva var. *succinea* Wheeler, Bull. Amer. mus. nat. hist., 1904, **20**, p. 369, ☿ .

WORKER. 4.5–6 mm.

Differing from the worker of the typical form in color, being throughout of a richer, purer, more reddish yellow, and in having the pubescence on the gaster even shorter and more inconspicuous. The whole surface of the body seems to be somewhat smoother than in the typical form and the integument harder.

FEMALE. Length 8–9 mm.

Whole body red, decidedly darker than the worker; mandibles more brownish, legs more yellowish. Wings colorless, with pale brown veins and stigma.

MALE. Length 8–10 mm.

Body long and slender. Head small, with very large eyes, broadly rounded behind. Cheeks very short, straight. Mandibles pointed, edentate, their blades rather broad. Clypeus carinate. Frontal carinae diverging. Maxillary palpi 6-jointed. Antennae very slender. Thorax narrowed in front. Petiole very thick and low, with a very blunt border, which, seen from behind, is transverse and feebly notched in the middle. Gaster long and slender. Stipes of genitalia long and slender, considerably surpassing the other appendages.

Head, thoracic dorsum, and epinotum subopaque; pleurae and gaster shining. Hairs very short, confined to the thoracic dorsum and top of head.

Honey yellow; ocellar triangle black; mesonotum streaked with brownish. Wings colored as in the female.

TYPE LOCALITY.— Texas: Austin (Wheeler).

Texas: Montopolis, Milano, Bee Creek (Wheeler); Victoria (Hunter).

Oklahoma: Ponca City (A. C. Burrill).

I have taken this form in the sandy or pebbly soil of the Texan post-oak woods and among the limestone hills of Travis County. It rarely

nests under stones but constructs craters two to four inches in diameter, with a central opening $\frac{1}{2}$–$\frac{3}{4}$ inches in diameter, made of coarse sand or pebbles. These nests resemble those of certain subspecies of *Myrmecocystus melliger* in Colorado, Western Texas, and Mexico. The beautiful yellow males and red females were taken May 26.

134. F. (N.) PALLIDEFULVA SCHAUFUSSI Mayr.

F. schaufussi Mayr, Sitzb. K. akad. wiss. Wien, 1866, **53**, p. 493, fig. 6, ♀; Verh. Zool. bot. ver. Wien., 1870, **20**, p. 951; McCook, Proc. Acad. nat. sci. Phil., 1880, p. 377; Ibid., 1887, p. 29; Dalla Torre, Catalog. Hymen., 1893, **7**, p. 212.

F. pallidefulva subsp. *schaufussi* Emery, Zool. jahrb. Syst., 1893, **7**, p. 654, taf. 22, figs. 17, 18, ♀; Wheeler, Bull. Amer. mus. nat. hist., 1904, **20**, p. 370.

WORKER. Length 5–7 mm.

Averaging somewhat larger than the preceding forms of the species, and differing also in having the two terminal joints of the maxillary palpi somewhat shorter and in pilosity and color. The erect hairs are longer and more numerous and are not only present on the gaster and upper surface of the head, but also on the gula, thoracic dorsum, and petiole. The pubescence is much longer and more distinct, especially on the gaster. The color of the head and thorax is more brownish yellow, the gaster more or less infuscated. The mandibles are red.

FEMALE. Length 8–10 mm.

Head, excluding the mandibles, as broad as long, rarely a little longer than broad. Thorax sometimes more slender than in the female of the typical *pallidefulva* and its variety *succinea*. Petiole broad, flattened behind, with entire, broadly rounded border. Sculpture, pilosity, and color as in the worker, hairs very long and abundant on the upper surface of the body, on the gula and petiolar border and especially long on the gaster. Mesonotum usually with three large, elongate brown spots, and the gaster with the bases and posterior borders of the segments a little more brownish than their central portions. In some specimens the whole of the mesonotum and gaster is deep brown. Wings hyaline, sometimes slightly tinged with yellow; veins and stigma pale brown.

MALE. Length 8–9 mm.

Mandibles edentate or obscurely bidentate, with rather narrow blades. Head as in the typical form of the species. Petiole low, thick in profile below, with a rather sharp upper border, which is distinctly excised in the middle; both its anterior and posterior surfaces

sloping. Gaster more shining than the head and thorax. Hairs rather short, pubescence short, rather dense on the gaster, indistinct elsewhere.

Head black, thorax, antennae, petiole, and gaster dark brown, genitalia scarcely paler than the gaster. Sutures of thorax, legs, and tips of mandibles brownish yellow. Wings as in the female.

Ontario: Toronto (R. J. Crew).

Maine: Ogunquit (H. S. Pratt).

New Hampshire: Durham (C. M. Weed).

Massachusetts: Andover, South Natick, Sherborn (A. P. Morse); Mt. Tom (G. B. King, Geo. Dimmock); Woods Hole, Boston (Wheeler).

Rhode Island: Providence (Davis).

Connecticut: New Haven (W. E. Britton, H. L. Viereck); Salisbury, Stafford (W. E. Britton); Winsted, Norfolk, Colebrook (Wheeler).

New York: Bronxville, Mosholu (Wheeler); West Farms (J. Angus).

New Jersey: Lakehurst, Ramapo Mountains, Weasel Mount, Great Notch (Wheeler); Alpine, Ft. Lee (W. Beutenmüller); Lucaston.

Pennsylvania: White Haven (J. C. Bradley); Chestertown (E. G. Vanatta); Lehigh Gap.

North Carolina: Black Mountains (W. Beutenmüller); Lake Toxaway (Mrs. A. T. Slosson).

Indiana: Pine, Shoals, Hammond, Wyandotte, New Harmony (W. S. Blatchley).

Illinois: Rockford (Wheeler).

Wisconsin: Milwaukee (C. E. Brown).

This is a very common form throughout the Northern States east of the Mississippi. It forms small or moderately large colonies which nest under stones or in obscure crater nests in open, sunny fields and pastures and on grassy hill-slopes. It is an extremely timid ant, usually fleeing with great precipitation when its nest is disturbed, never stopping to defend itself and returning to secure its brood in a furtive and hesitating manner. It lives largely on dead insects and the excreta of aphids. I agree with Emery that the male and female described by Mayr as belonging to this form may be more properly referred to the subsp. *nitidiventris*.

135. F. (N.) PALLIDEFULVA SCHAUFUSSI var. DOLOSA Wheeler.

F. pallidefulva schaufussi var. *meridionalis* Wheeler, Bull. Amer. mus. nat. hist., 1904, **20**, p. 370, ☿ .

F. pallidefulva schaufussi var. *dolosa*, nom. nov. Wheeler, Psyche, 1912, **19**, p. 90.

WORKER. Length 5–7 mm.

Resembling the typical *schaufussi* in all respects except that the gaster is scarcely darker than the remainder of the body and the pubescence on the gaster is much longer and denser so that it appears more opaque.

FEMALE. Length 9–10 mm.

Differing from the female of the typical *schaufussi* in the same characters as the worker and also in the coloration of the mesonotum, which is immaculate and of the same brownish yellow tint as the remainder of the body.

TYPE LOCALITY.— Texas: Bull Creek (Wheeler).

Texas: near Austin (Wheeler); Arlington (W. E. Hinds); Edna (J. D. Mitchell).

Arkansas: McNeil (J. D. Mitchell).

Louisiana: Gilliam (F. C. Bishop), Mansfield (W. E. Hinds).

Missouri: Doniphan (P. J. Schmitt).

North Carolina: (P. J. Schmitt).

Georgia: Atlanta, Gainesville, Black Rock Mountain, Rabun County, 3,500 ft. (J. C. Bradley).

This is a distinctly southern variety of *schaufussi*, apparently constant, to judge from the specimens I have seen. I have found it nesting in obsure crater nests in grassy places in the dry canyons of Central Texas. Its habits are essentially like those of the northern *schaufussi*.

136. F. (N.) PALLIDEFULVA SCHAUFUSSI var. INCERTA Emery.

F. pallidefulva schaufussi var. *incerta* Emery, Zool. jahrb. Syst., 1893, **7**, p. 655, ☿ ♀ ♂; Wheeler, Bull. Amer. mus. nat. hist., 1904, **20**, p. 370; Ibid., 1906, **22**, p. 52; Ibid., 1907, **23**, p. 37.

WORKER. Length 4.5–7 mm.

This form differs from the typical *schaufussi* merely in the slightly less abundant pilosity. The hairs on the gula and petiole are few, and may be lacking on one of these regions but very rarely on both. The pubescence is often somewhat shorter and sparser but there seems

to be no very constant difference in coloration, although in general the gaster is often fuscous or even blackish and the head and thorax may have a deeper, more brownish or reddish tint.

FEMALE. Length 8–9 mm.

Color, as a rule, darker than in the female *schaufussi*. In addition to the three dark spots on the mesonotum, the gaster and the posterior portion of the head may be dark brown, the former sometimes blackish. Hairs and pubescence sparser and shorter than in the type, gaster smoother and more shining.

MALE. Length 7–9 mm.

Indistinguishable from the male of the typical *schaufussi*.

TYPE LOCALITY.— District of Columbia (Th. Pergande).

Virginia: (Th. Pergande).

New Jersey: Lakehurst, Weasel Mt. (Wheeler); Alpine, Ft. Lee (Wm. Beutenmüller).

New York: New York (C. T. Brues); West Farms (J. Angus); Bronxville, Tuckahoe (Wheeler); Niagara Falls, Arlington, Staten Island (Wheeler).

Pennsylvania: Ashbourne; Lehigh Gap.

Connecticut: Colebrook, Winsted, Norfolk (Wheeler); Bradford (Winkley); Rockville (H. L. Viereck).

Massachusetts: Wellesley, Sherborn (A. P. Morse); Boston (Wheeler); East Northfield (A. C. Burrill).

New Hampshire: Durham (C. M. Weed).

Illinois: Rockford (Wheeler).

Wisconsin: Racine, Milwaukee (C. E. Brown).

Colorado: Colorado Springs, Cheyenne Canyon (Wheeler).

New Mexico: Las Valles (Miss Mary Cooper).

This variety, which lives in the same situations and has the same habits as the typical *schaufussi*, though ranging considerably further west, is, as Emery observed, very unstable or variable both in color and pilosity. Some pale specimens are almost indistinguishable from *schaufussi* while others are smaller, more deeply colored and have so few hairs and such short pubescence that they are equally close to *nitidiventris*. Moreover, such different forms are often present in the same colony.

137. F. (N.) PALLIDEFULVA NITIDIVENTRIS. Emery.

F. schaufussi Mayr, Verh. Zool. bot. ver. Wien, 1886, **36**, p. 427, ♀ ♂.

F. schaufussi subsp. *nitidiventris* Emery, Zool. jahrb. Syst., 1893, **7**, p. 656, taf. 22, figs. 13, 19, ☿ ♀ ♂; Wheeler, Bull. Amer. mus. nat. hist., 1904, **20**, p. 37.

Worker. Length 4–6 mm.

Differing from the preceding forms of *schaufussi* in its smaller average size, pilosity, pubescence, and usually also in coloration. The hairs, though present on the upper surface of the head and thorax and on the gaster, are lacking on the gula and petiole. The pubescence is extremely short and sparse, so that the gaster is much more shining. The head, thorax, petiole, and appendages are often red or brown and much darker than in *schaufussi* and the gaster is dark brown. Often also the back of the head is darker than the thorax.

Female. Length 6.5–8 mm.

Smaller than the female of the preceding forms and more deeply colored. The head, thorax, antennae, and legs are yellowish or reddish brown, with the upper surface of the head, posterior border of pronotum, three large spots on the mesonotum, disk of scutellum, meso- and metapleurae, and gaster dark brown. Whole surface of body very smooth and shining. Pilosity similar to that of the worker, but longer on the gaster. Pubescence also somewhat longer but not obscuring the shining surface. Wings grayish hyaline, with brown veins and stigma.

Male. Length 7–9 mm.

Differing from the male of the preceding forms in coloration. The head is black; the mandibles, scapes, thorax, and petiole brownish yellow; the funiculi and gaster dark brown, the genitalia yellow and more or less infuscated. The pleurae, scutellum, and epinotum are spotted with fuscous and there are three large, elongated fuscous spots on the mesonotum. Antennal scapes and tarsi sometimes brown. In some specimens the whole mesonotum is fuscous and in others the lighter portions of the thorax are brown instead of yellow. In still other specimens the whole thorax is dark brown with yellowish sutures. Wings as in the female.

Type locality.— District of Columbia (Th. Pergande).

Virginia: (Th. Pergande).

North Carolina: Black Mountains (Wm. Beutenmüller).

New Jersey: Halifax (Wheeler).

New York: Mosholu (Wheeler).

Pennsylvania: Beatty (P. J. Schmitt).

Connecticut: Colebrook (Wheeler); New Haven (Butrick); Salisbury, New Haven, Orange (W. E. Britton).

Massachusetts: Wellesley (A. P. Morse); Essex County (G. B. King); Forest Hills, Blue Hills, Woods Hole (Wheeler); Arlington (Mus. Comp. Zoöl).

Indiana: Hammond, Kosciusko County, Marion County (W. S. Blatchley).

Illinois: Algonquin (W. A. Nason); Rockford (Wheeler).
Colorado: Manitou, Colorado Springs, Colorado City (Wheeler).
New Mexico: Las Vegas (Wheeler).
Quebec: Hull, near Ottawa (Wheeler).
Ontario: Grimsby (Wheeler).

Emery regards as the type of this subspecies "workers, which have about the color of the subsp. *schaufussi*," but such individuals are too pale to represent the subspecies properly, which is decidedly darker. It is in fact often so dark as to merge into *fuscata*. Such transitional forms are also cited by Emery from South Dakota but he evidently regarded them as *fuscata*. Emery refers the male and female described as *schaufussi* by Mayr to this subspecies.

F. nitidiventris closely resembles *schaufussi* and *incerta* in habits, but nests in more shady situations, along the borders of woods, etc. In geographical range it seems to coincide very closely with *incerta*, from which it is sometimes distinguishable only with difficulty.

138. F. (N.) PALLIDEFULVA NITIDIVENTRIS var. FUSCATA Emery.

F. pallidefulva subsp. *fuscata* Emery, Zool. jahrb. Syst., 1893, **7**, p. 656, ♀ ♀.
F. pallidefulva nitidiventris var. *fuscata* Wheeler, Bull. Amer. mus. nat. hist., 1904, **20**, p. 370.

WORKER. Length 4–6 mm.

Characterized by deeper coloration and feebler pilosity. The body is dark reddish brown or blackish, the anterior portion of the head and legs paler; mandibles, antennae, tarsi, tibiae, and articulations of legs red or yellowish. Tips of funiculi infuscated. The surface of the body is sometimes more sharply shagreened and therefore somewhat more opaque than in *nitidiventris*, the hairs even sparser on the head and usually wanting on the thorax. The pubescence is very short and sparser and much as in *nitidiventris*.

FEMALE (DEÄLATED). Length 7–9 mm.

Dark reddish brown or blackish; mandibles, scapes, pronotum, petiole, legs, and sometimes also the mesonotum yellowish. Hairs more abundant and longer than in the worker, present also on the thoracic dorsum. Surface of body shining, much as in the female of *nitidiventris*.

TYPE LOCALITY.— Pennsylvania: Beatty (P. J. Schmitt).
North Carolina: Black Mountains (Wm. Beutenmüller); Lake Toxaway (Mrs. A. T. Slosson).
Georgia: Thunderbolt, Savannah (J. C. Bradley).
New Jersey: Halifax (Wheeler).

New York: Bronxville (Wheeler).

Massachusetts: Essex County (G. B. King); South Natick (A. P. Morse); Forest Hills, Blue Hills, Woods Hole (Wheeler).

Illinois: Rockford (Wheeler).

South Dakota: Hill City (Th. Pergande).

New Mexico: Las Vegas (Mrs. W. P. Cockerell).

Ontario: Guelph (W. H. Wright).

This form is regarded by Emery as a distinct subspecies, but in my opinion it is hardly more than a melanic variety of *nitidiventris*. Unlike the preceding forms it nests only in woods, usually in hilly country and is much rarer than any of the other varieties or subspecies.

139. F. (N.) MOKI Wheeler.

F. moki Wheeler, Bull. Amer. mus. nat. hist., 1906, **22**, p. 343, ♀ .

WORKER. Length 4–5.5 mm.

Mandibles 8-toothed. Maxillary palpi very long, 5-jointed. Head, excluding the mandibles, decidedly longer than broad, narrower in front than behind, with straight posterior border and sides. Eyes large and convex. Clypeus strongly carinate, its anterior border rounded, projecting. Frontal carinae but slightly diverging behind Antennae long and slender; scapes scarcely curved at the base; middle funicular joints more than $1\frac{1}{2}$ times as long as broad. Thorax long and narrow, in profile very low; pro- and mesonotum much depressed, mesoëpinotal constriction shallow and very long at the bottom. Epinotum with straight, horizontal, basal surface, nearly twice as long as the very sloping declivity. Seen from above the pronotum is as long as broad, mesonotum nearly twice as long as broad. Petiole narrow, thick at the base, with sharp horizontal border, and both the anterior and posterior surfaces, but especially the latter, distinctly flattened, so that the segment is cuneate in profile. Gaster small. Legs long and slender.

Opaque, finely shagreened; even the mandibles and frontal area only slightly lustrous; the former finely and densely striated and coarsely punctate. Head behind with a bronzy or glossy surface.

Hairs white, sparse, pointed on the upper surface of the head, obtuse on the gaster; absent on the gula, petiole, and upper surface of the thorax. Legs with only the series of oblique bristles on the flexor surfaces of the tibiae. Pubescence grayish, fine and rather dense, covering the whole surface of the body and appendages, longest on the gaster.

Dull reddish yellow; gaster, posterior half of head above, terminal

FIG. 10.— Distribution of the subgenus Neoformica.

joints of funiculi, a large spot on the pronotum, a smaller one on the mesonotum, the upper surface of the petiole, the coxae, femora and in some specimens also the apical half of each tibia and the pleurae, dark brown or fuscous.

TYPE LOCALITY.— Arizona: Bright Angel Trail, Grand Canyon 5,500–7,000 ft. (Wheeler).

Arizona: Prescott (Wheeler).

Utah: Milford (J. C. Bradley).

This species appears to belong in the *pallidefulva* group, although the sculpture of the body is very unlike that of the preceding species. Superficially it resembles *F. rufibarbis*, but the head, thorax, and antennae are much more like those of *pallidefulva*. There is, however, much that recalls Myrmecocystus in the structure of the thorax seen in profile.

F. moki nests under stones and forms colonies about the size of those of *F. pallidefulva* and its various subspecies and varieties. It probably represents this species in the dry deserts of the southwest, but is certainly a much rarer ant.

ADDENDUM.

The following notes and descriptions relate to specimens discovered after the manuscript of this paper was ready for the press.

140. F. TRUNCICOLA INTEGROIDES var. RAVIDA, var. nov.

WORKER. Length 4–6 mm.

Like the var. *haemorrhoidalis* Emery in pubescence and sculpture and in lacking erect hairs, except on the gaster, but differing in color. The red of the head, thorax, and petiole is much deeper and not yellowish, the legs, whole of the funiculi, tips of the scapes and the gaster are black and even the largest workers have a large black spot on the pro- and mesonotum. In small workers the red color is darker and more brownish, the whole thorax is blackish and the posterior portion of the head and the whole of the scapes are infuscated. The surface of the body in all of the workers is opaque, the pubescence on the gaster short, dense and dark gray in color; the red anal spot is much restricted.

FEMALE. Length 8.5–9 mm.

Differing from the female of *haemorrhoidalis* in having the tips of the scapes, the posterior border of the pronotum, three spots on the

mesonotum, the whole of the scutellum and metanotum, a few spots on the mesopleurae and the middle and hind legs, including their coxae, black.

Described from two females and seven workers collected by Mr. W. M. Mann at Elkhorn, Montana. He has also taken six workers at Helena in the same state. The two females are immature so that the red of the head and thorax is paler and more yellowish than in the workers. The opacity of the body and the character of the pubescence on the gaster in both female and worker show clearly that this variety is to be referred to the subspecies *integroides* Emery and not to *integra* Nylander.

141. F. SUBPOLITA var. FICTICIA, var. nov.

WORKER. Length 3–6 mm.

Very closely resembling the typical form from California but differing in having the head less deeply and less extensively infuscated behind, the thorax bright red and rarely infuscated even in the small workers, the erect hairs, especially on the pronotum and gula, less numerous, the petiolar border sharper and more compressed, and the antennal scapes a little less enlarged towards their tips.

FEMALE. Length 8.5 mm.

Differing from the female of the typical form in having the clypeus, cheeks, and pleurae red, the mesonotum less shining and the wings somewhat shorter and more nearly colorless.

MALE. Length 7.5–8 mm.

Differing from the male of the typical form in color, the gaster being black, instead of reddish yellow, with the genital appendages more or less infuscated or black. The stipes of the genitalia are broad and blunt, the subgenital plate broad, the gaster compressed dorsoventrally The head is shaped as in the typical form, the wings paler.

Described from one female, five males, and twelve workers taken by Mr. W. M. Mann at Helena, Montana. He has also given me eight workers from Elkhorn in the same state. It is interesting to find this form so far inland from the Pacific Coast. The discovery of the male is somewhat disconcerting, since it would seem to indicate that after all *F. rufiventris* Emery may not be, as I have stated, the male of the typical *subpolita* Mayr, but the male *ficticia* agrees so closely with the form described by Emery, except in the color of the gaster, that I am not ready to admit myself mistaken, especially as the females of the typical *subpolita* vary from black to yellowish red in the color of the gaster.

142. F. MICROGYNA RASILIS var. PULLULA, var. nov.

WORKER. Length 3.5–6 mm.

Differing from the typical *rasilis* in color, the red portions of the body being decidedly darker and more brownish red. The petiole is more compressed anteroposteriorly, with a sharper border, which is more produced upward in the form of a blunt point. The erect, blunt hairs on the upper surface of the head and thorax, especially on the latter, are shorter and even less numerous. In many specimens they are altogether lacking on the front and thorax.

FEMALE. Length 5 mm.

Differing from the female of *rasilis* in color and in the shape of the petiole. Head, thorax, and gaster dark brown or blackish; mandibles, clypeus, cheeks, and gula dark red; antennal scapes, propleurae, epinotum, petiole, and legs somewhat paler, dull red. Head and thorax opaque, gaster slightly glossy, with very short, rather sparse pubescence. Wings grayish hyaline; stigma light brown, veins paler. Petiole as in the worker, but its border even more produced and attenuated in the middle.

Described from numerous workers and three winged females taken from two colonies at Flathead Lake, Montana, by Prof. C. C. Adams. In the coloration of the worker and shape of the petiole this variety resembles *F. adamsi* Wheeler, but is larger and the head and thorax are at most very faintly and diffusely clouded with fuscous and not spotted.

143. FORMICA MICROGYNA RASILIS var. NAHUA, var. nov.

WORKER. Length 4–6 mm.

Differing from the worker of the typical *rasilis* in having the petiole narrower and its margin distinctly blunter, the erect, obtuse hairs on the head and thorax somewhat more numerous and also present on the border of the petiole and on the gula; the sculpture is somewhat sharper, so that the sides of the head are opaque like the remaining surface, and the color of the gaster is darker and more blackish. Even the largest workers have no infuscation on the ocellar triangle and very rarely have faint blotches on the pro- and mesonotum. The tibiae are naked as in the typical *rasilis*.

FEMALE. Length 6 mm.

Differing from the female of *rasilis* in being a little larger and more robust, in having more numerous erect, obtuse hairs on the head, thorax, and gaster, a blunter petiolar border and in color, which is

like that of the worker, with red and not brownish yellow, head, thorax, petiole, legs, and antennae. The wings seem to be a little darker than in the typical *rasilis*.

MALE. Length 7 mm.

Differing from the male of the typical *rasilis* only in having somewhat darker wings and a more opaque gaster.

Described from several specimens of all three phases taken by Mr. W. M. Mann at Guerrero Mill (9,000 ft.) and Velasco in Hidalgo, Mexico, from populous colonies nesting under stones banked with vegetable detritus. These colonies were very sporadic, but each contained a large number of the small, winged females. Mr. Mann also found these females (deälated) in two colonies of *F. subcyanea*, sp. nov. (*vide infra*), thus proving that this is the temporary host of *nahua*.

144. FORMICA SUBCYANEA, sp. nov.

WORKER. Length: 4–5.5 mm.

Closely related to *F. fusca*. Head as broad as long, a little narrower in front than behind, with feebly convex sides, rounded posterior corners and straight posterior border. Eyes rather large. Clypeus sharply carinate, with entire, slightly reflected but not produced anterior border. Antennae rather stout, the tips of the scapes a little thicker and the terminal funicular joints a little shorter than in *fusca*. Shape of thorax, petiole, and gaster as in *fusca*, the petiole having a convex anterior and flat posterior surface and a broadly rounded, entire upper border.

Body, including the appendages, opaque, very coarsely shagreened and in this respect resembling *F. fusca* var. *japonica*; gula and mandibles a little more shining, the latter coarsely striatopunctate.

Hairs short, white, erect, a little more abundant on the head and thorax than in *fusca*, obtuse on the gaster. Gula in the middle with a very few erect hairs (1–4). Pubescence yellowish, extremely short, moderately abundant on the head and gaster, less conspicuous on the thorax and appendages.

Deep black throughout, including the antennae, legs, palpi, and mouthparts; only the strigils of the fore tibiae and in some specimens the bases of the scapes, reddish. Body in bright sunlight with distinct, deep metallic blue and bronze reflections.

FEMALE. Length 8–9 mm.

Very much like the female of the typical *F. fusca* in size and shape. Differing from the worker in having longer pubescence on the body and in lacking the metallic blue reflections, though there is more or less

of the bronzy effect. The sculpture is as coarse as in the worker or even coarser, especially on the gaster, but the surface of the body, and especially of the scutellum, epinotum, and gaster, is a little more shining. Wings distinctly infuscated, much as in *F. fusca* var. *subsericea*, with blackish veins and stigma.

Male. Length 9 mm.

Differing from the male of the typical *fusca* in having the wings distinctly infuscated, the bases of the femora and the tips of the external genital appendages more blackish, the surface of the body more coarsely punctate and more opaque and of a deeper black color. The erect hairs on the head and thorax are much more abundant and the pubescence on these parts and on the gaster is distinctly longer and coarser. The mandibles are bluntly dentate.

Described from numerous workers and females and one male taken by Mr. W. M. Mann at Guerrero Mill (9,000 ft.), Velasco, below Real del Monte, El Chico and Pachuca, in Hidalgo, Mexico. Mr. Mann found this ant to be more pugnaccous than *fusca* and its var. *subsericea*. It nests in large colonies under stones in exposed, open localities, such as hill-tops, but more commonly in shady places where the soil is moister.

Were it not for the erect hairs on the gula of the worker and female, and the peculiar sculpture and metallic coloration one would be inclined to regard this ant as a subspecies of *fusca*. It should be placed just after *F. sybilla*, which it resembles in pilosity though it differs in the worker phase in having a stouter body, shorter head, antennae and legs, larger eyes, a much broader petiole and different color and sculpture. The male *sybilla* differs from that of *subcyanea* in having much longer, broader, and more yellowish wings (10 mm. long, as compared with 8 mm. in the latter species), more pilose and more coarsely sculptured head and thorax, broader gaster and somewhat more compressed petiole.

Formica rufibarbis Fabr. var. gnava Buckley. (Page 518).

Workers and winged females indistinguishable from the more northern specimens of this variety were taken by Mr. Mann at Guerrero Mill and El Chico in Hidalgo, nesting under stones or in mound-nests. The colonies were less populous than those of *F. subcyanea*.

Formica cinerea Mayr var. altipetens Wheeler. (Page 523).

A few workers found by Mr. Mann running on cactus at Pachuca in Hidalgo agree very closely with the types of this variety from Colorado.

All the foregoing Mexican forms, though occurring as far south as latitude 20° N., were found only at rather high altitudes. In addition to these four forms and *F. perpilosa*, described on p. 421, several other Formicae have been recorded as occurring in Mexico by Forel in the "Biologia Centrali-Americana," namely *F. fusca* var. *subsericea*, *F. rufibarbis*, *F. neorufibarbis*, which Forel regarded as a var. of *rufibarbis*, *F. rufa obscuripes*, and *F. incisa*. Concerning these forms I venture the following remarks:—

1. *F. fusca* var. *subsericea* is recorded from Durango, 8,100 ft. (Forrer), Atoyac in Vera Cruz (Schumann), and Moyoapam (Coll. Saussure). This is much more probably *F. fusca* var. *argentea* Wheeler.

2. *F. rufibarbis* is cited from Sonora (Morrison) and Omilteme in Guerrero (H. H. Smith). This is probably the form which I have called *F. rufibarbis* var. *occidua* and not the typical specific form which is Palaearctic.

3. *F. rufibarbis* var. *neorufibarbis* Forel, which is recorded from Durango, 8,100 ft. (Forrer), is probably the var. *gnava* Buckley.

4. For *F. rufa obscuripes* only the locality "Mexique (Brinkmann)" is given. This form may, perhaps, occur in the high mountains of Northern Mexico, but I am inclined to believe that the specimens to which Forel refers belong to some other *rufa* form or to some member of the *microgyna* group.

5. *F. incisa* was described by F. Smith from a female specimen, with the locality "Mexico." As Forel says, it is an "espèce extrêmement douteuse et indéchiffrable," but it can hardly be the female of some form of *F. rufibarbis*, as he suggests, because the coloration of this species is very different.